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Boston Surgical Society.

DIVISION OF THE URETER IN PELVIC OPERATIONS.*

By WILLIAM P. GRAVES, M.D., BOSTON.

Dr. Scudder has asked me to report in greater detail the cases of division of the ureter that I mentioned in the clinical meeting last month at the Free Hospital for Women.

CASE 1. Operation October 31, 1907. The patient was a married woman of 45. The operation was for an immense fibro-adenocystoma of the uterus, which completely filled the abdomen. The tumor was densely adherent, as these rare tumors practically always are. The urine before operation was normal. The tumor was freed on the right side, the ureter being exposed along most of its course and not injured. The ureter on the left was found to enter the tumor at a point about an inch above the brim of the pelvis. On account of the length and severity of operation, it was thought best not to attempt to dissect the ureter from its bed in the tumor. The ureter was, therefore, deliberately cut above the brim of the pelvis, and again at a point near its entrance into the bladder. Inasmuch as the right kidney felt normal and the right ureter was intact, the proximal stump of the cut ureter was tied with strong silk about an inch from the end. The cut end was then sewed over with catgut. The proximal stump next to the bladder was tied with catgut. The patient made a good recovery from the operation, but had complete anuria for 36 hours. She was treated with hot packs, nitre and pilocarpin. At the end of 36 hours she began to pass urine and excreted 31 ounces in the following 24

hours. From that time she made an uninterrupted convalescence. There was no pain or tenderness of the left kidney and no apparent hydronephrosis. The opposite kidney, however, underwent a very marked compensatory hypertrophy which was noted within a few days after the operation. The patient was followed for several years, and remained in perfect health. The right kidney continued to be hypertrophied.

CASE 2. Operation October 31, 1907. The patient was a single woman of 27. The operation was for a large cervical fibroid which was tightly packed in the pelvis, extending principally into the right, broad ligament. In cutting the right uterine vessels the right ureter, which was displaced from its normal position, was completely severed. After removal of the fibroid uterus by a complete hysterectomy, the left kidney and ureter were inspected and found to be intact. The injury to the right ureter was too high to allow for convenient implantation in the bladder, so that the only alternatives were anastomosis or tying of the ureter. On account of the recent experience from the preceding case, in which the patient had had anuria for 36 hours, it was decided to perform an anastomosis. An end-to-side anastomosis of the severed ureter was performed in the classical way (illustration on black-board). The patient passed 11 ounces of urine during the 12 hours following operation, and continued to pass a normal amount thereafter. Nine days after the operation bladder symptoms appeared with rise of temperature, malaise and pus in the urine. This attack, which was evidently a pyelitis, lasted two or three days, recurred 10 days later, and again recurred 10 days after that. Each attack of pyelitis was short in duration. After discharge from the hospital, the patient continued in excellent health, her case being followed for several years.

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CASE 3. Patient was a single woman of 58. Operation, November 14, 1916. The operation was for a very large pseudo-mucinous cyst filling the abdomen and densely adherent. The worst adhesions were in relation to the right ureter, which could not be definitely distinguished. Great care was exercised to avoid cutting the ureter, but when the uterus was removed, it was found that the ureter was held within two clamps and almost completely severed. In this case the injury was sufficiently near to the bladder to allow for implantation, so that the operator had a choice of implantation, anastomosis or ligature. In considering the experience of the two former cases of cut ureter, it seemed that the patient in whom the ligature had been employed had made the better convalescence. In view of the fact that the patient had undergone a long and severe operation, and in view also of the favorable reports of ligature, especially from the Mayo Clinic, it was decided to tie the ureter. In this case three separate ligatures of No. 2 chromicized catgut were placed at about one inch apart in order to secure complete closure. The purpose of using several ligatures placed at a distance was to allow for a certain amount of necrosis of the ureteral epithelial lining with the formation of plastic adhesions. This patient made an uneventful recovery. There was no palpable hydronephrosis on the right side, nor was the compensatory hypertrophy of the opposite side sufficient to be detected by examination. There was no pain or tenderness of the kidney on the side of the ligated ureter.

CASE 4. In addition to the three personal cases which I have cited, I will add one from the service of one of my colleagues. The operation was for a large cervical fibroid, during the enucleation of which one of the ureters was cut. In this case the ureter was implanted into the bladder. Soon after the operation a urinary fistula appeared per vaginam. The fistula persisted for several months, after which the patient was lost sight of.

When a ureter has been accidentally cut, the surgeon usually has the choice of several procedures. Ligating the ureter has certain advantages over anastomosis and implantation. It requires very little expenditure of time, usually an important consideration, as the operations in which the ureter is cut are generally of great severity. If the end of the ureter is properly tied there is little danger of leakage and fistula.

According to Barney's statistics, hydronephrosis occurs in 80 per cent. but the hydronephrosis is as a rule not great and gradually subsides as the kidney atrophies.

If a dangerous hydronephrosis should occur the kidney may be removed at a later operation.

Anuria appears, according to Barney, in about 1.6 per cent. after ligation of one ureter. It is probable that ureteral anastomosis is more commonly followed by fistula and infection than is the ligature operation. It is evident from the literature that most of the cases of death following ligation of the ureter have been due to shock following some extremely severe operation, rather than to the closure of the ureter.

If the choice is between anastomosis and implantation I should personally prefer an anas-

tomosis. By anastomosis only one organ is injured. If a fistula or pyelonephritis ensues the kidney may be removed and the trouble cured by one operation.

If a fistula follows implantation in the bladder the surgeon then has to deal with two injured organs. The operation for reimplantation or closure of a ureterovesical fistula is, in my opinion, less satisfactory than a simple nephrectomy, such as might be necessitated by trouble from ligature or anastomosis.

If implantation is imperative, as might be the case in the presence of injury of the other ureter, or a functional deficiency or disease of the opposite kidney, the place of choice would be, of course, in the bladder, if the proximal end of the ureter is sufficiently long.

In case of emergency the ureter may be left to drain from the vagina or carried out through the skin.

Implantation into the intestine is not desirable on account of the almost inevitable ascending infection of the kidney.

Implantation into the appendix or of one ureter into the other, and even into the Fallopian tube, are operations that have been advocated from experiments on animals and on the cadaver, but probably have no very practical value.

DISCUSSION.

DR. WILLIAM L. ESTES, S. Bethlehem, Penn.: My experience in division of the ureter has been of a very limited order. I have done anastomosis in two cases, and tied off in one. One of the anastomoses did perfectly well, and one, I think, died, rather from shock of operation than severance of the ureter.

I should like to say in regard to the remark of Dr. Graves concerning infection of ureters implanted into the intestines, that I have done an implantation into the rectum for extrophy of the bladder in a child nine years ago, and the child is to-day doing very well.

DR. COBB: I have had four cases in which I divided, unintentionally, the ureter, three were carcinoma of the cervix and one a very large fibroid in a negro. I did an anastomosis after the method just sketched by Dr. Graves; the first case died of shock largely due to the increased time taken by the anastomosis. One case of carcinoma recovered uneventfully and in two cases, one of carcinoma and one of fibroid, I had to do a nephrectomy four or five weeks after the operation.

DR. RUSHMORE: One of the major operations of gynecology has been described as tying four arteries and one ureter, and it has been said that one does not qualify as a gynecologist until one has actually cut across the ureter. However that may be, the subject of Dr. Graves' paper is of great interest and importance to everyone who does many pelvic operations.

I have had experience in three cases in which I cut the ureter. In one, in Baltimore, in which the operation was for a large myoma of the uterus, Dr. Kelly performed the anastomosis. The method was that just described by Dr. Graves: end-to-side. The patient did perfectly well.

The second case was operated on for carcinoma of the cervix with involvement of the ureter. I resected the ureter and implanted the proximal end into the bladder. The third was for carcinoma of the cervix. By accident I cut across the ureter, and then tied it. I think it would have been better to have left it alone because the patient was in such poor general condition and suffering from shock; to have left it alone would have given a little better chance.

One point in regard to the method of implantation into the bladder. I prefer some modification of the method suggested by Dr. Coffey. The incision is made first through the muscle, down to the mucosa, then the mucosa is punctured a short distance above the lower end of the incision. The ureter is best cut obliquely, not directly across, so as to give a sort of flap and that flap is drawn down into the bladder with a fine piece of catgut needled at both ends. The bladder wall is punctured by the needles from within outward and the ureter anchored by a suture, the knot of which lies outside the bladder. The bladder wall is then inclosed around the ureter and part of the muscle may be cut away to give less pressure.

The result is to approximate rather closely the valve-like opening that is naturally found between the ureter and the bladder.

In regard to results in these three cases, the first case did perfectly well. The case of carcinoma of the cervix in which the ureter was resected for about an inch and a half and implanted into the bladder, did perfectly well. A cystoscopic examination with catheterization of the ureter showed no evidence of disturbance of function. The third case died about thirty-six hours after the operation from shock.

In anastomosing ureter to ureter, a danger is the occurrence of a stricture, which predisposes to pyelitis.

DR. A. L. CHUTE: I cannot agree with Dr. Graves in the procedure of tying off a cut ureter without making an attempt to see whether the kidney cannot be saved. I feel that one should see whether something cannot be done in the way of a conservative operation, before tying off the ureter and destroying the kidney, as this means. If too much of the ureter has not been removed, it is perfectly possible to reimplant it into the bladder. I prefer this, if it can be done, rather than to make an anastomosis between the cut ends of the ureter.

I believe it is possible, if it be necessary, to free the ureter from its bed for at least one-half its length. This will allow bringing the ureter to the bladder comfortably in most cases. In women,—and of course all these cases occur in women,—the reimplantation is simpler than in men. I pass a number 10 or 12 ureter catheter to the bladder, make a small incision in the bladder wall at the place where I mean to implant the ureter and fish my catheter out through this incision. I then pass the catheter up the ureter for 3 to 8 cm., after which I introduce the ureter containing the catheter into the bladder for about a half inch, sew up my incision about my ureter, and catch the ureter to the

bladder wall at two or three points. There is little tendency to leakage in my experience, although I usually do carry a wick down to the point of suture. This procedure may be carried out rapidly. I have used it after resecting a tumor of the bladder involving the ureter, and in one case where the ureter had been injured during hysterectomy. I had an opportunity to see the latter case some months after operation, and found that she had a perfectly patent ureter, showing no particular contraction. Whether we can hope for this result in most cases or not, I do not know, but I feel we should make some effort to save the kidney in these instances where a ureter has been accidentally cut.

In all, I have seen four cases where the ureter has been tied off, severed, or wounded in doing hysterectomy. In the first case, which I saw a considerable time after operation, an abdominal urinary fistula had developed. A nephrectomy was done and the patient did well. In the second instance, both ureters had been tied off. I saw the patient about fifty-six hours after operation and did a double pyelostomy. The patient died some three days later. I have never been quite sure as to the cause of her death, since she was said to have passed a fair amount of urine following the double pyelostomy. I saw the third patient five weeks after operation. All the urine from the left side leaked through the vagina. This is the reimplantation that I have already referred to. The fourth case is one that I saw recently, and in this instance I believe the injury to the ureter was due to a needle prick. The amount of leakage has diminished; it looks to me as though this patient would require nothing in the way of operation, but that the injury would heal of itself.

DR. GRAVES: (Dr. Graves, in closing, spoke of the technic of implantation.) A very rapid method of implanting the ureter into the bladder is to split the proximal end of the ureter as one would a dandelion stem. The split end is then carried into an opening in the bladder by guide sutures. Two or three fine catgut sutures are used to make the joint more secure. (Illustrated on the blackboard.)

Another method of implantation, if the ureter is too short to reach the bladder, is that suggested by Albarran. A flap is turned up from the bladder and wrapped about the end of the ureter, the opening in the bladder being sewed up by a running suture. (Illustrated on the blackboard.)

In order to avoid stricture at the point of implantation Stoeckel suggests the following: Instead of making a slit in the bladder a round hole is cut about the end of a clamp which has been inserted through the urethra into the bladder cavity. The mucous membrane and peritoneum are sewed together before the ureter is implanted. (Illustrated on the blackboard.)

FRACTURES OF THE EXTERNAL CONDYLE OF THE HUMERUS IN CHILDHOOD, WITH ROTATION OF THE CONDYLAR FRAGMENT.*

BY JAMES S. STONE, M.D., F.A.C.S., BOSTON,
Surgeon to the Children's Hospital.

OPERATIVE intervention in fractures involving the elbow joint in children is ordinarily of very

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FIG. 1.—Illustration showing the typical rotation of the fragment.



FIG. 2.—Illustration showing the callus growing from the fragment giving it a rounded outline. Periosteal callus growing from the shaft at the side. Slight callus growing from the fracture surface at the lower end of the shaft. X-ray taken two months after the injury.

doubtful benefit. There is, however, a perfectly definite type of fracture, or rather epiphyseal separation of the external condyle of the humerus, which practically invariably demands prompt open reposition of the fragment. The cases are those in which the epiphyseal fragment has become rotated in such a way that the slightly cup-shaped fracture surface faces out-

ward and usually slightly upward and backward. It can easily be felt just beneath the skin unless there is unusual swelling, and can be recognized readily by the clean cut edges and the slightly depressed centre. The rounded joint surface lies more or less in contact with the epiphyseal line or fracture surface of the shaft, or with the outer anterior surface of the bone just above the fracture surface. There is a space between the shaft of the humerus and the head of the radius, where the epiphyseal fragment normally belongs, which is filled with blood clot.

The periosteum is often torn off from the outer side of the shaft for a little distance upward, but may remain attached to the outer border of the rotated epiphyseal fragment. Under these conditions the torn-off periosteum may be more or less stretched across the fracture surface of the fragment. The displaced fragment may often be readily moved about, and may sometimes be pushed inward more or less into the gap from which it came, but in most instances it is impossible by manipulation to rotate the fragment back into place so that the fracture surfaces lie in contact. The fragment has rotated beyond a dead centre and is locked there.

What happens if it remains in its abnormal position? New bone grows down from the fracture surface of the lower end of the shaft toward the joint, more or less filling in the gap left by the displacement of the fragment. This callus growing downward comes in contact with the synovial surface of the rotated fragment. Thus bony union is unlikely. New bone also grows out from the fracture surface of the fragment, which, as already stated, is pointing outward and upward. The callus growing out in a sort of groping manner does not meet the shaft at all. It finds no solid bone to which it may unite the fragment. Some callus may grow from the separated periosteum at the outer side of the shaft, which may thus make a bone bridge to unite fragment and shaft, or the union between the two may remain fibrous. Under these conditions the fragment becomes a roughly rounded projecting mass, more or less firmly united to the shaft, and mechanically obstructing the free movement of the joint.

The treatment demanded early after one of these fractures has occurred, is open incision, exposure of the fragment, removal of the clot and any fibrous tissue which may occupy the space from which the fragment came, and then with a blunt dissector the prying of the fragment into place in its normal position. The procedure is simple, but the force needed to rotate the fragment back into place when everything is in sight, shows how useless are prolonged attempts at reduction by manipulation.

The open reduction should be done within the first few hours or else after a sufficient interval for the swelling and ecchymosis to have subsided.

It is possible to restore the fragment to its normal position even after an interval of two months, although such a delay is never advisable. In that time much new bone will have formed both below the fracture surface of the shaft and from the fracture surface of the fragment. But this new bone at first will be found to be very soft and easily wiped away with a curette. The cavity from which the fragment came and the fragment itself may be restored to their original shapes and placed in their normal relations.

After an interval of more than two months, however, it will be impossible to differentiate between the old bone and the new. Adaptive changes in the shapes of the bones will have occurred. The problem will no longer be one of restoring a displaced fragment to the place from which it came, but will be one of securing the best possible functional result under abnormal conditions. The treatment must, of course, be determined by the conditions in each case, but as a rule, the excision of the enlarged and useless fragment will give better results than any plastic bone repair.

The after-treatment of the early cases is simple. No suture of any sort need be put in the bone. Usually it is impossible to stitch the periosteum. There is no tendency to displacement once the fragment is replaced. Acute flexion locks the fragment in place. Stitches in the fascia and skin hold everything securely. These are usually inserted while the elbow is held flexed. It is much easier under these conditions to adjust the edges of the skin wound if the incision has been made L shaped rather than curved.

Acute flexion may be maintained for a fortnight. The arm may then be put in an internal angular splint and later in a sling. Normal motion is promptly restored unless prevented by meddlesome passive motion.

DISCUSSION.

DR. SCUDDER: I have seen two or three of these cases. One was some time after the injury, and another was a comparatively recent case. In one I excised the fragment, and in the other the fragment was put back in place. I found that the acutely flexed position, as Dr. Stone has suggested, is all that is necessary to keep the fragment in place.

THE APPLICATION OF THE MEDIAN PATELLA INCISION FOR A KNEE ARTHROTOMY.*

By E. G. BRACKETT, M.D., BOSTON,
Surgeon to Orthopedic Department, Massachusetts
General Hospital.

The median patella route of the knee joint is indicated in those conditions demanding an exploration of the anterior chamber of the joint, as well as the removal of definitely loose bodies,

not permanently located, for osteochondritis dissecans, and for the repair of crucial ligaments. It is an incision of considerable magnitude, but under proper precautions, and with the necessary care, it is a safe procedure, to be used when there is real reason for its use. It is not followed by a reaction proportionate to its apparent radicalism, as a rule, no more than in the usual arthrotomy. The operation is facilitated very considerably by the attention to a few details of technic, and since this route is comparatively new, it may be of value for those who have used it to some extent, to record their experience in regard to these details.

The incision must be long, particularly above, where it must extend to above the upper border of the lower third of the thigh, and below to beyond the tubercle of the tibia. Above, the incision should slant distinctly to the outside, to follow the line of direction of the tendon of the quadriceps. The dissection of the tissues overlying the tendons need be carried laterally only far enough to disclose the edges of both the quadriceps and patella tendons. This much is necessary to insure a median division of these tendons, which otherwise is not easy. The periosteum of the patella is cut through, but not retracted, and extended into but not through the quadriceps and patella tendons sufficiently to mark the line of incision. The patella is split by a saw cut, a little to the inside of the middle line, to leave the outside fragment a little larger than the inner, and to aid still further in this, the saw cut may be slanted inward, to make the under side of the outer fragment wider than the upper. This also gives firm apposition in closing, as the tension of the tendon crowds the overhanging inner fragment down on the outer. This is not easy except with a small and fine saw, and the tendons must be first split; otherwise they will be frayed by this procedure. Ordinarily the straight cut is sufficient and often better. The saw cut is most easily begun with the knee in the extended position, and when the groove is well made, completed with the knee flexed at 45° or more, in which position it is held firmly in place. The patella tendon can be divided by a single cut, but with the quadriceps it is necessary to divide it in layers, particularly in its upper part, as the fibers here are placed in a kind of spiral arrangement, the under fibers having a direction toward the inside, and the outer towards the outside, and this separation is carried on horizontally.

The alar ligaments and sub-patella fat pad are divided directly in the middle line, with the knee flexed, taking care to preserve the attachment of the ligamentum mucosum, which will usually be found on the inner half. By this median division, the fat pad, with its synovial covering, can be brought together again, and leaves no raw surface exposed to the inner surface of the joint. It frequently is necessary to detach the alar ligament and the pad from the middle of

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the anterior surface of the tibia, to which it is only lightly attached. For a good view of the crucial ligaments it is necessary, and particularly so to find and remove a cartilage. This is easily stitched back to the place of its old attachment and apparently does no harm. This is, however, not a good approach for cartilage, and is unnecessarily extensive.

Sterilized absorbent cotton wet in normal salt solution, is preferable for sponging, for all possible friction to the synovial membrane is to be avoided. The author has used silk for all parts of the closure. Nos. 6 to 8 for the synovial membrane, quadriceps pouch and both edges of the tendons. No. 14 for the patella suture—one on either edge, above and below, taking in a bit of the tendon, which gives a firm, strong hold; and one or two between, taking in the periosteum and expansion of the tendon of the quadriceps. It apparently is not necessary to sew through the patella to insure good apposition, for the tension of the tendon is sufficient to keep the fragments in firmly together. Fixation is not used, except by posterior Cotton splint, which keeps the knee from full extension, and gives sufficient protection, yet allows a little motion, which is desirable. When leaving the bed, the patient wears a split plaster, which is used during the time of being up for a month or six weeks,—passive motion is allowed from the first, and given after two weeks, but never to beyond the point of pain. Weight-bearing in the plaster is allowed in a month, and full normal use expected at the end of two months.

DISCUSSION.

DR. PAINTER: I think this operation has probably done more for joint surgery at the knee joint than almost any other innovation that has been introduced, certainly since the aseptic handling of the operative field.

The points that Dr. Brackett has made, I think, are particularly worth bearing in mind; particularly the point concerning the careful readjustment of the synovial membrane and the structures that have been divided, because it is the leaving of these in an unsatisfactory condition which is responsible for some of the discomfort and retardation in restoration of function after joint surgery. Of course, one of the things that militates against the interference with conditions in the joint has been the fear that motion could not be restored after major operations, and this method of approaching the joint has done away with this to a very considerable extent. I have not had the opportunity of doing this operation very many times, but it has seemed to me that one of the ways in which this may be of great service to us is in making exploratory incisions in cases where they are necessary. For those of us who believe there is such a thing as primary synovial tuberculosis,—which is very difficult to diagnose,—this operation offers an opportunity to explore the joint much more satisfactorily than any other incision with which I am acquainted, and it does so with very much less likelihood of any permanent interference with the mobility of the joint in case the condition which is expected, and to find out which the operation is per-

formed, is not present, and the real condition is one which does not necessitate more radical procedure. If it should not prove to be a synovial tuberculosis, the joint would not be damaged. If it did prove to be synovial tuberculosis, the appropriate operative procedure could be carried out.

DR. ROBERT B. OSGOOD: In observing these cases I have been struck with two things: First, the lack of operative reaction and, second, the speed with which function has returned. The convalescences have been entirely uneventful.

This incision was devised by Mr. Robert Jones and Alwynne Smith and illustrated by them in an article appearing in the *British Journal of Surgery*, April, 1913, upon Rupture of the Crucial Ligaments and Fractures of the Spine of the Tibia.

Dr. Corner has advocated it also in several articles (*Lancet*, May 9, 1914; *Journal A. M. A.*, Sept. 26, 1914), believing that rupture of the crucial ligaments is not uncommon in severe injuries to the knee. He advances the theory that foreign bodies (joint mice) do not as a rule come from injuries to the condyles and subsequent separation of the cartilage, but from tears of the synovial membrane, closely adherent as it is to the crucial ligaments and therefore easily torn. A flake of fibrin collects and a foreign body nucleus is formed and, as Dr. Codman has shown, gradually increases in size.

The diagnosis of complete rupture of the crucial ligaments is interesting. The ligaments are made tense by any attempt at forward and backward displacement of the tibia on the femur and by inward rotation of the tibia on the femur. The anterior prevents forward and back motion in extension of the leg, the posterior in flexion of the leg, and if both are ruptured there would be an excess of internal rotation of the tibia on the femur.

Corner believes that the repair of these ligaments ought to be done through this incision, the torn ligament being reefed by a non-absorbable ligature which is then carried up through a drill hole in the condyle and tied.

Mr. Jones is sure that they nearly all recover more successfully if they are simply put at complete rest for several months as soon as they can be diagnosed, and advises against operation in the majority of cases.

I believe this is not the incision of choice when a definite diagnosis of a slipping or torn semilunar cartilage has been made. These cartilages can be reached more easily by the lateral L-shaped incision of Mr. Jones, the knee being flexed over the end of the table.

DR. SOUTTER: There is very little to add to what has already been said. The anterior median incision at the knee will give a very complete exposure. When the incision is used in low-grade infectious conditions, in the aged, the operation must be done rapidly. A very fine approximation of the patella is necessary. In these cases the tendon above, sutured rapidly, has been sufficient for later function, in cases infected. This incision allows a pannus to be carefully removed and the joint wiped out. Using this incision in infectious cases, any necessary drainage is possible by tubes inserted into lateral punctures (one inch long) made from within outward, similar to the axilla drainage which is used following breast amputation. One case, an old man, had constant night and day pain, only

slightly relieved by morphine after using the median incision. The joint was very much better drained and cleaned out than by two lateral incisions. The latter would have injured the capsules to a greater degree than the lateral punctures for drainage just described. The operation was done hastily, with careful approximation of the patella and rapid suture of the tendon above, with hardly any pain following the operation and ninety degrees of ultimate motion.

DR. CHEEVER: I have operated on 4 or probably 5 cases by this method. Dr. Brackett properly lays great stress on causing as little trauma as possible, and has mentioned that he does not divide the ligamentum mucosum for this reason. In my cases, this ligament has usually been divided, in order to facilitate exploration of the joint, and there have been no noticeable ill effects, since the cases have all made uncomplicated recoveries.

I should like to suggest the use of sterile rubber dam or gutta percha tissue to cover the articular cartilage of the condyles of the femur during their exposure to prevent the desiccation that occurs and which undoubtedly constitutes an injury.

DR. BRACKETT (closing): Dr. Osgood has said that the incision is not adapted for the removal of the cartilage, which fact should be emphasized, yet although it is not the route of election, the cartilage may be removed through it. The difficulty lies in reaching far enough posteriorly to detach thoroughly the cartilage, but in cases of doubtful diagnosis, when an exploratory opportunity is desirable, this route may be chosen.

THE MANAGEMENT OF OPERATIVE CASES PRESENTING URINARY BACK PRESSURE.*

BY ARTHUR L. CHUTE, M.D., BOSTON.

In order that we may have urinary back pressure acting on both kidneys, it is necessary that the obstruction be either at, or external to, the bladder outlet. There are only two common conditions that fulfil this requisite,—prostatic obstruction and tight stricture of the urethra. Practically the condition is always limited to adult males. Congenital strictures in children and strictures of the urethra in women are known, but are too rare to have any real importance.

This subject of the management of cases showing urinary back pressure seems to me of the greatest importance, though it has as yet received relatively little attention, especially from the general surgeons, due, largely, I believe, to the limited conditions under which it is found, partly to a more or less vagueness that surrounds certain phases of it. My opportunity to study this condition has been mostly with cases having back pressure due to prostatic obstruction. I have seen relatively few cases in which

the back pressure has followed a tight stricture, but with the exception that the stricture patients are younger and, therefore, a little better risks, the conditions and dangers have seemed the same.

In my earlier prostatic work, which was done wholly under ether anesthesia, I lost patients whom I should not have lost, and lost them often when I least expected to do so. These patients were often fair operative risks from the general surgical point of view, that is, they showed a moderately good heart; often a urine that was not bad, and sometimes even a clear urine; their blood pressures were not necessarily high; some of them were not very old; on the whole, they were not men whom one would consider good risks, but were patients on whom any reasonable operation should be followed by recovery. The one thing, however, which these patients invariably showed was a residual urine, usually considerable in amount, often turbid, sometimes clear. The fatalities in these cases came usually in from three to five days after operation, and in many instances were supposed to be due to hemorrhage, since the urine was rarely clear of blood by that time. Sometimes the fatal outcome was considered due to a myocardial heart, or delayed shock, or some other vague or rather unsatisfactory cause, but rather directly due to the operative procedure carried out on the prostate.

Some years ago, I lost, within a few days of one another, two patients that raised a question in my mind as to whether the operation on the prostate was the real cause of death in these cases. One of these patients was a doctor, with a large amount of clear residual, whom I sent into a hospital and catheterized, at first intermittently, later continuously. This procedure, which was preparatory to getting him into condition for a prostatectomy, I carried out with the greatest care it was possible for me to exercise. A very competent medical man cooperated with me in the care of this patient, and yet we saw him develop the dry tongue, slightly distended abdomen, hiccough, mental dulness, nausea, bloody and then diminished amount of urine, and the same general picture, ending in death, that I had seen in fatal post-operative prostatic cases. It seemed evident that this man died of pyelonephritis as the result of infection following my catheterization.

In the case of the other patient, I determined to avoid the danger of what one might call "closed" bladder infection by supplying adequate drainage from the start. This man also had a complete retention with an infected urine; he had vomiting and showed marked dyspepsia urinaria. I opened his over-distended bladder under ether. He developed the same signs as the first patient except that he had suppression of urine from the start, and his vomiting continued without intermission. He died 28 hours after operation. It was perfectly clear that pros-

* Read before the Boston Surgical Society, January 10, 1917.

tatectomy had nothing to do with the deaths of these patients, and yet they presented much the same signs as the fatal cases following that operation, and in which, as I have said, the outcome was supposed to depend on some danger inherent to the removal of the prostate.

These two cases led me to formulate the hypothesis that interference with the function of the kidney was the important element in deaths following prostatectomy. Some years of observation have convinced me of the truth of this hypothesis, and have impressed upon my mind its great importance. Perhaps I can cite no more telling evidence in support of this than the fact that previous to two weeks ago, when I had the misfortune to lose a man following prostatectomy for cancer, who died of sepsis following the careless administration of salt solution, I had done forty consecutive prostatectomies without a death. These patients ranged in age from 47 to 90; they presented both benign and malignant growths; they were done by both the suprapubic and perineal routes; they had both general and spinal anesthesia. The only thing I did for these patients in common was to take the utmost care of their renal function.

As these patients with back pressure come to us, we can divide them into two classes: those with clear urine, and those with infected urine. Contrary to what many people believe, the patient with the infected urine is rather the better risk, as he has developed a certain immunity which the patient with the clear urine does not possess. However, this rule is not without its exceptions. My observations, which have been wholly clinical, point to the fact that the danger in these cases depends upon two different renal conditions, both of which may lead to renal insufficiency and a fatal toxemia. The simplest of these conditions is an acute congestion of the kidney, which follows the relief of a long-standing back pressure. It is attended by a scanty amount of highly albuminous urine, not infrequently bloody. There is sometimes renal tenderness and a slight increase in size of the kidneys. This hyperemia, if such it be, is accompanied or followed at times by a definite infection of one or both kidneys, instanced sometimes by definite pain in one or both loins and accompanied by moderate tenderness. These rather more definitely localized signs, however, are not always present by any means. This latter condition of renal infection is, of course, more serious than the hyperemia. Added to either of these conditions or to the combination of both, we may have that peculiar toxic injury to the kidney that ether exerts upon it, intensified, naturally, when the kidney is already partly crippled. Renal insufficiency, having its origin in either of the above types of renal injury, may lead to fatal toxemia if not recognized and treated.

The management of these cases is largely prophylactic, partly therapeutic. The congestion

that follows the relief of any continued back pressure cannot be avoided, and it may be so intense as to produce what is practically suppression, but is usually less severe. Its treatment consists in the use of fluids by mouth and by rectum, occasionally by the use of salt solution under the skin. Cardio-renal stimulants of the caffeine group I have thought rendered me good service in this condition. In the matter of the infections that extend from the bladder to the kidney and which are most common in cases presenting a non-infected residual we are able to exert a certain amount of prophylaxis. In my experience these cases are less frequent when one opens the bladder suprapubically for drainage than when one attempts to drain the bladder by means of a catheter. Whether one drains an over-distended bladder by use of a catheter or by suprapubic incision, he is perfectly sure to infect the bladder. With a large tube in the bladder, we get the best possible drainage and apparently diminish the probability of renal infection.

The third injury to the kidneys—the injury which ether exerts upon them—may, of course, be wholly prevented by substituting local or spinal anesthesia. Some people believe that gas oxygen anesthesia is equally safe. My experience with it is too small to allow me to draw a definite conclusion. Ether is certainly very dangerous in these cases with urinary back pressure.

When we have renal insufficiency present, due to any of the above factors, the most effective treatment is by the introduction of large amounts of fluid. This is introduced preferably by mouth; by rectum if it is not well borne by mouth; by infusion of salt solution if it is necessary. Contrary to what one might believe, functional rest is not what the kidneys need under these circumstances. They should be pushed to their utmost; in bad cases I push the fluid until either the toxemia clears or edema of the serotum develops. The amount of salt solution that can be given under the skin with benefit is often very large. I have given 750 cc. at eight-hour intervals for twenty consecutive times. Although this patient was unconscious at one time, he made a good recovery eventually; and his recovery, without any doubt in my mind, was not in spite of his salt solution, but due to it.

The time at which it is necessary to begin to push the fluid with these cases is not definitely fixed. A marked diminution in the amount of urine excreted should put one on his guard and lead to increase of fluids. It is, therefore, very essential that after any operation on a patient showing urinary back pressure, especially a prostatic patient, that one know the amount of urine excreted. In many cases the constant irrigation of these patients, which has made it impossible to notice early a diminution in the excretion of urine, has, in a way, been responsible

for the patient's death. One of the earliest and least recognized signs of toxemia, due to renal insufficiency, is a soft distention of the abdomen. Its presence should lead to vigorous pushing of fluids. A dry tongue, hiccoughing, vomiting and mental confusion are all more marked signs and should lead to still more active measures. One should not despair, even with patients who are almost in coma, though good results are rarely gotten at this time.

There are several more or less pertinent facts that I wish to refer to briefly. One is the caution that one should use in placing too much importance upon kidney function tests, in these cases with urinary back pressure. This caution, so far as I am aware, applies no more to the use of one test than to another; and should be exercised in two directions: thus, while it should not discourage us from hoping for a favorable result in a patient showing a very low functional ability, it should not lead us to relax our care in the least in a patient showing a high renal function. The reasons are these: first, in the presence of urinary back pressure, none of the renal tests can give us the potential power of the kidney. Its poor output may simply be due to the embarrassment of back pressure—after the simile of the water wheel which is backed up by high water in the stream below. The efficiency of the kidney may improve wonderfully with the removal of this back pressure.

Two of my patients who went safely through prostatectomy last summer showed, as nearly as we could determine, a phenolsulphonephthalein output of only a little over 5%. On the other hand, no matter how good the functional ability of a kidney may be, one can never predict the degree of harm that an infection may inflict upon it, and, therefore, it should be guarded with the utmost care.

The degree of renal injury that back pressure may cause, and the degree of recovery that is possible, following its removal, was very strikingly shown by a patient under my care a few months ago. This patient, a man of 66, entered the hospital with general edema of a marked degree. Just after the opening of his bladder under novocaine, which I did more from a sense of duty than because I expected to be able to accomplish much, this man excreted 50 grams of salt in 24 hours on a salt-free diet. When last seen, early in December, this man emptied his bladder completely, had no edema, had a normal output of salt on an unrestricted diet.

In the light of the above experience, I make it a rule in the care of prostatitis with a considerable residual and consequent urinary back pressure, to open the bladder under local novocaine anesthesia. This is done to rid the kidneys of the embarrassment of urinary back pressure and to minimize, as far as possible, the chances of renal infection from an infected bladder. The enucleation of the prostate, which is done at a later date, is always

carried out under spinal anesthesia in the bad cases, in order that one may not add to the damaged and especially susceptible kidneys the injury that ether so often brings about.

Such cases of urinary back pressure as I have seen in the past year or two, that have been due to stricture of the urethra, have been operated upon under local novocaine anesthesia. Some have shown a certain amount of extravasation. These patients have, without exception, done extraordinarily well when compared with the behavior of similar patients that I formerly operated upon under ether. In my belief, the difference is due to sparing the disabled kidneys the extra injury that ether inflicts.

It is my firm belief that the mortality in conditions attended with urinary back pressure, especially in prostatectomy, depends upon the condition of the kidneys more than upon the technic of the operation; that much can be done by careful preparation and after-care to determine the post-operative result in these cases.

DISCUSSION.

DR. E. GRANVILLE CRABTREE: I find myself in complete agreement with Dr. Chute's views concerning the management of back pressure kidneys. I think he has hit the point on the management of these cases when he emphasizes that avoidance of disturbance of kidney equilibrium is important.

I have followed a small group of these cases of back pressure kidneys with frequent functional tests, 5 to 10 on a case, during the period of pre-operative preparation with a view to determine the nature of functional changes. The back pressure kidneys fall into two classes, the overdistended uninfected cases and the infected group. I have seen a patient of the first group enter the hospital with a red test of 45%, his function fall to 15% to 20% when he is decompressed by bladder drainage, and be still further depressed with the advent of infection to 5% or 10%. He later recovers to somewhere near his former level. On the other hand a case having led a catheter life for some time will be found to have a low function at entrance to the hospital but gradually to improve or at least remain constant when drained. In either case a stable level of renal function is safe for operation. We, just as Dr. Chute mentions, see a small group of patients who will stand operation on a 5% or 10% function. We are willing to operate on these cases when we are convinced that that represents a stable level of renal activity for that patient and is the best he can do.

I have elsewhere mentioned and merely repeat it here, the high mortality which attended early prostate operations was due to lack of preliminary renal preparation by drainage. The patient was compelled to withstand decompression, infection and operation all at one time and the burden was too great to bear. The effect of some form of preliminary drainage has the effect of distributing the three damaging factors in such a way that the patient is called upon to carry but one at a time.

DR. R. F. O'NEIL: Dr. Chute's convincing presentation opens up a large field of discussion, but it

is impossible to cover more than one or two points in the time at hand.

In his title he lays particular stress only upon those cases of prostatic obstruction in which there is overdistention or complete retention. I am a strong advocate of suprapubic drainage in these cases, particularly those with an uninfected urine, as clinically they do better under this method than any other. I have employed it a number of times and have never regretted having done so, while on one or two occasions where I have not employed it, I have been sorry. I think the chances of renal infection are much diminished and the patient more easily brought to a state of stable equilibrium.

Another very important point is the use of fluids before and after operation and the early recognition of the symptoms calling for their administration, that is, the slight abdominal distension, hiccoughs, mental haziness and vomiting. Much can be done for these patients by the prompt administration of salt solution by mouth, or if the patient is delirious or unconscious, by rectum or under the skin. I remember two recent cases of my own where adequate pre-operative treatment could not be given because the prostate had to be removed for hemorrhage, and was of such size as to prevent preliminary suprapubic drainage. These cases both became delirious, with dry tongue and other signs of renal insufficiency, but made a good recovery after forced administration of salt solution; one patient receiving a subpectoral infusion five times at intervals of six hours.

ACUTE AND SUBACUTE PERFORATIONS OF THE STOMACH AND DUODENUM AT THE MASSACHUSETTS GENERAL HOSPITAL.*

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THE following paper is based on the acute and subacute perforations of the stomach and duodenum at the Massachusetts General Hospital, 104 in number, occurring in 103 patients. Cases of chronic perforation, walled off by adhesions, showing neither acute peritonitis nor abscess formation, have not been included. This series includes the total experience of the hospital from the first operation in 1896 through 1915, a period of twenty years, which may be subdivided into two periods of ten years each, the first including the development of diagnosis and operative measures, the second, a more or less standardized treatment. Both periods are included, for although the first period may not give a true idea of the present operative results, yet it contributes to a consideration of incidence and symptoms, and provides a few surviving cases in which the late results are known.

The purpose of the paper is to consider the results of operative treatment with special attention to the advisability of a primary gastro-

enterostomy as well as closure of the perforation, although the statistics afforded by this group of cases have also been included.

There were 90 operations for perforation in 89 cases, one duodenal case re-perforating at the end of three months. These operations were performed by 23 surgeons, the largest number falling to any one man being 11. 14 patients died without operation. Of this latter group of 14 cases, 5 were moribund on admission, operation was considered inadvisable in 3, and error in diagnosis occurred in 4 cases, while 2 cases gave no clinical evidence of perforation, which was discovered unexpectedly at autopsy. The clinical diagnosis was confirmed by autopsy 11 times in this group. Five of the cases were gastric and 6 were duodenal. It is fair to assume, from the clinical history and examination, that the remaining cases also had gastric or duodenal perforation.

Of the operated cases, 76 showed an open perforation without walling-off, 6 a diffuse peritonitis although the perforation appeared sealed at the time of operation, and 8 a more or less local abscess.

The operative cases were classed at the time of operation as either gastric or duodenal. These, together with the non-operated cases confirmed by autopsy, gives a group of 100 patients, of which 43 had gastric and 57 duodenal perforations. This grouping, especially in the earlier operated cases, is necessarily somewhat inaccurate; nevertheless, of 8 cases classed as gastric coming to autopsy following operation, 6 were gastric and 2 duodenal, while all of the duodenal group coming to autopsy following operation were found to be duodenal. Consequently I feel that although the gastric group may include duodenal cases, nevertheless, there is sufficient preponderance of gastric cases to make any difference between the two groups real and not apparent. Since the gastric and duodenal perforations are by no means identical in clinical course or amenability to treatment, these two groups are analyzed separately, except where the location of the perforation was indifferent to the fact considered.

In sex there is a marked difference between gastric and duodenal groups. The gastric cases include 24 men and 19 women, or 55.8% of men. The duodenal cases include 54 men and 3 women, or 94% of men.

The average age of gastric cases is 33 years, of the men 36.8, of the women 27.7 years. The youngest was 18, and the oldest 72.

The average age of the duodenal cases in men was 33.4 years. The youngest was 21 and the oldest 67.

Arranged by decades:

	GASTRIC		DUODENAL	
	MEN	WOMEN	MEN	WOMEN
Under 20	1	1		
20-29	3	11	13	2
30-39	3	3	16	
40-49	7	1	13	

* Read before the Southern Surgical Society, Dec. 12, 1916, and before the Boston Surgical Society, Jan. 10, 1917.

	GASTRIC		DUODENAL	
	MEN	WOMEN	MEN	WOMEN
50-59	5	1	9	1
60-69	4	2	3	
70+	1			
TOTAL	24	19	54	3

The striking thing from these figures is the predominance of duodenal perforations in men, and the occurrence of gastric perforations in women, particularly between 20 and 30. Both types of perforation in men are well spread out through middle life, the duodenal occurring slightly earlier than the gastric. Given an acute perforation in a woman, these figures would suggest that it is six times as likely to be gastric as duodenal.

Perforation was in all instances, as far as observed, single. The location of the perforation was determined by autopsy in 17 duodenal and 11 gastric cases, and approximately noted at operation in 24 gastric and 29 duodenal.

The gastric perforations found at autopsy were located as follows:

Anterior wall—8 cases.

- 1 anterior wall near lesser curvature 2 cm. above pylorus.
- 1 2 cm. above pylorus.
- 1 anterior wall of stomach.
- 1 anterior wall, $3\frac{1}{2}$ cm. above pylorus, in anterior part of saddle ulcer of lesser curvature.
- 1 anterior wall 10 cm. above pylorus.
- 1 anterior wall 10 cm. above pylorus.
- 1 anterior wall of lesser curvature near middle of stomach.
- 1 anterior wall, middle of stomach, near greater curvature.

Posterior wall—3 cases.

- 1 posterior wall at pylorus, perforating anteriorly through lesser omentum.
- 1 posterior wall, upper part of lesser curvature.
- 1 posterior wall, midway between greater and lesser curvature, 7 cm. from oesophageal opening.

The location of the gastric perforations, observed at operation but not confirmed by autopsy, was stated as follows:

Anterior wall—22 cases.

- near pylorus—10.
- lesser curvature, near pylorus—4.
- middle of lesser curvature—1.
- high on lesser curvature—2.
- near cardiac end—2.

Posterior wall—2 cases.

These figures show the predilection for the anterior wall near the pyloric end and along the lesser curvature to be expected. Perforation on the posterior wall occurs sufficiently often to be a possibility worthy of consideration.

Location of duodenal perforations as shown by autopsy cases was:

Anterior wall, superior aspect—5 cases.

- anterior superior aspect, immediately below pylorus—4.
- anterior superior aspect, 1 cm. below pylorus—5.
- anterior aspect, 1.5 cm. below pylorus—1.
- superior aspect—1.

Posterior wall—2 cases

The greatest distance noted below the pylorus was 1.5 cm.

Operative findings as to the location of the duodenal perforations not confirmed by autopsy were stated as follows:

1st part, unspecified—12 cases.

1st part, anterior wall—8 cases.

1st part, superior aspect—4 cases.

1st part, inferior aspect—1 case.

anterior wall, 8 fingers below pylorus—1 case.

posterior wall, 1st part—2 cases.

posterior wall, upper second part—1 case.

These figures emphasize what a small area of the duodenum is usually penetrated by these ulcers, and the great vulnerability of a point on the anterior superior aspect, within one or two centimeters of the pyloric ring. A common type of lesion at autopsy was a transverse ulceration close to the pylorus, involving the posterior and superior wall of the duodenum, and perforating at its anterior end through the anterior aspect of the duodenum.

The process tended to become localized about equally in both gastric and duodenal cases. The omentum appeared to close or partly close the perforation 5 times in gastric cases. This was not noted in the duodenal cases. In these when apparent sealing took place it was due to fibrin or adhesion to neighboring organs.

Many cases gave at the time of perforation a history of antecedent indigestion. This was considerably more frequently true in the gastric than in the duodenal cases. These symptoms may be classified in three groups,—first, digestive symptoms suggestive of ulcer; second, digestive symptoms too indefinite or too slight to suggest the source; and third, no digestive symptoms whatever. In 33 gastric cases, symptoms suggestive of ulcer, 49%; indefinite digestive symptoms, 36%, no digestive symptoms, 15%. The duodenal cases showed digestive symptoms suggestive of ulcer, 16%, indefinite digestive symptoms, 54%, no digestive symptoms, 30%.

Duodenal perforations, consequently, appear more likely to occur without any previous warning in the way of digestive symptoms than gastric perforations. In only a small proportion of duodenal cases is the history previous to perforation sufficiently definite to be an aid in differential diagnosis. In gastric perforations, how-

ever, the previous history would appear a definite help in about one-half of the cases.

Premontory symptoms preceding perforation occurred in a considerable number of cases, in the form of definite increase in pain, tenderness, or distress following eating. The exacerbation of symptoms usually preceded perforation by three or four days, rarely as much as two weeks, and is probable attributable to peritoneal irritation from thinning of the ulcer base.

The onset was sudden in 90% of the cases. Occasionally there was a sense of something giving away. The pain was described as sharp, knife-like, agonizing, excruciating, prostrating. In contra-distinction to the pain of appendicitis, which is usually first general and then becomes local, the pain in perforation tends more to be local at first, becoming more diffuse with the spreading of the extravasated fluids. The commonest location was in the epigastrium and right hypochondrium. The principal tenderness corresponded in general with the principal pain. In duodenal cases, the greatest tenderness was referred particularly to the right side, principally the right hypochondrium, but frequently extending down the right flank into the right iliac fossa. In gastric cases, the pain and tenderness although usual in the epigastrium and on the right, might show its maximum on the left and extend down the left flank. The greater tenderness was on the left in about 15% of the gastric cases.

Spasm was commonly general, frequently board-like in character, the greatest spasm usually corresponding in location to the greatest tenderness.

Occasional vomiting occurred in 83% of the cases. It was usually not a prominent or persistent symptom.

Elevation of temperature was usually slight in this series. It was normal or subnormal on admission in 35% of the cases. The highest temperature on admission was 103°.

The leucocyte count on admission was noted in 62 cases. The minimum count was 6,000, the maximum 56,000, both occurring in fatal cases. The average count of the fatal cases was 18,500, of those recovering 19,800. The white counts in both series, those recovering and those dying, showed very similar variations, and no general conclusion as to a prognostic value in the white count could be drawn.

Liver dullness was said to be obscured in 15 cases, and diminished in 11 more. While this physical sign may occur, it seems that these figures tend to exaggerate its frequency. Its presence in a few instances is of little value in the diagnosis of the average case.

Distention was present only as a late development. The abdomen was usually flat, occasionally retracted. When present it is a bad prognostic sign. 18 cases in which more than slight distention was noted gave an operative mortality of 72%.

At the present time the matter of diagnosis needs little discussion. The fact that there is a surgical emergency demanding operation is reasonably clear in all cases.

Confusion with appendicitis occurs especially in the duodenal cases, in which the gravitation of the duodenal contents down the lumbar gutter between the ascending colon and the right flank may give rise to an apparent maximum of tenderness and spasm in the right iliac fossa. In such cases at operation the character of the peritoneal fluid, usually thin and odorless, and considerable in amount, in combination with an appendix, which if abnormal at all, shows only superficial injection without tenseness or necrosis, or possibly adherent fibrin, which it shares with other peritoneal surfaces, should make exploration of the stomach and duodenum an obvious necessity. Disease of the gall-bladder which gives sufficient disturbance for confusion with perforated ulcer should be obvious on exposure of the gall-bladder. At operation the same incision fortunately gives access to the duodenum and pyloric end of the stomach.

A probable preliminary diagnosis of appendicitis, as shown by the location of the first opening in the peritoneum was made in 31% of the duodenal cases. In only two cases coming to autopsy, however, was the source of the peritonitis apparently not suspected at operation. This confusion occurred principally in the earlier cases. In the gastric cases the first peritoneal opening was less frequently low.

Of 90 perforations in 89 cases treated by operation, 32 died, a general mortality of 35.5%. If we include 14 cases dying without operation, the total mortality of the cases admitted is 44.2%. Eight cases, all of which recovered, showed a more or less local abscess at the time of perforation. This leaves 82 cases, 48 duodenal and 34 gastric, which showed a diffuse peritonitis at the time of operation. Of the duodenal cases 15 died, a mortality of 31%; of the gastric 17 died, a mortality of 50%.

These figures, including a period of twenty years, do not give a fair idea of the mortality of perforation with diffuse peritonitis at the present time. If they are divided into two periods of ten years, the second period will more nearly represent the present mortality.

From 1896 through 1905 inclusive, the gastric cases were 11 in number, of which 7 died, and 4 recovered, a mortality of 64%. The duodenal cases were 7 in number, of which 5 died and 2 recovered, a mortality of 77%.

From 1906 to 1915 inclusive, there were 23 gastric cases, of which 10 died and 13 recovered, a mortality of 43.5%. The number of duodenal cases was 41, of which 10 died and 31 recovered, a mortality of 24.4%.

The following table gives an analysis of the mortality for five-year periods.

	GASTRIC			DUODENAL		
	R	D		R	D	
1896 to 1900	1	3-75 %	died	2	100 %	died
1901 to 1905	3	4-57 %	"	2	3-60 %	"
1906 to 1910	10	6-37.5 %	"	12	5-29.4 %	"
1911 to 1915	3	4-57 %	"	19	5-20.8 %	"
	17	17-50 %	died	33	15-31.2 %	died

This table shows a steady lowering of the mortality of duodenal perforations while that of gastric perforations remains high. It also shows an increasing frequency of duodenal as compared with gastric ulcers, probably due in large measure to more accurate localization. In spite of any such error in localization, it would seem assured that gastric perforation carries a considerably higher mortality than duodenal.

The following reasons may partly explain this difference. Duodenal perforations occur in a limited area, while gastric perforations may occur over a wide extent of stomach. A duodenal perforation may therefore be found more quickly and with less manipulation. The possible greater accessibility of duodenal perforations may also favor ease and rapidity of closure. The pyloric sphincter may lessen the outpouring of gastric content through a duodenal perforation, the leakage from which might be limited chiefly to the duodenal contents. The anatomical situation of the duodenum, and its relation to surrounding structures, may limit the dissemination of fluid from the perforation to a greater extent than in perforation of the body of the stomach.

The chief factor in mortality in cases with diffuse peritonitis is distinctly the elapse of time from perforation to operation. Thus the elapse of time after perforation in 27 duodenal cases recovering was 14°, in 11 fatal cases, 25°. The elapse of time in 15 gastric cases recovering was 17°, in 16 fatal cases 19°. Cases which showed a localization of the peritonitis have not been included in these figures.

In this connection, the cases which died in the hospital without operative interference are of some interest. Of 14 cases dying without operation, 8 gave a sufficiently definite history to enable one to estimate the duration of life from the time of perforation to the time of death. The longest survival from perforation to death was 51°, the shortest 24°, and the average 32°. Consequently, if a case is operated on toward the end of the second day, the margin of resistance is naturally extremely small. One may conclude in cases that survive much beyond the second day, that localization of the peritonitis

has occurred, aided presumably by sealing of the perforation or by its small size or position.

Age is an important factor in mortality. In considering this point, I have taken only the second decade, since technical errors are less important as a factor in mortality in this period. The average age of the duodenal cases recovering in 1906-1915, was 36 years, of those dying, 50 years. The average age of the gastric cases recovering was 32 years, of those dying, 51 years. The influence of age on mortality is more clearly shown by decades.

GASTRIC CASES

60-67	3 cases	100 %	died
50-59	4 "	100 %	"
40-49	4 "	25 %	"
30-39	3 "	0	"
19-29	9 "	22.2 %	"
	23 cases	43.5 %	died

DUODENAL CASES

60-67	3 cases	100 %	died
50-59	6 "	33.3 %	"
40-49	10 "	30 %	"
30-39	12 "	16.6 %	"
21-29	10 "	0	"
	41 cases	24.4 %	died

The conclusion seems clear, therefore, that age is an extremely important factor in prognosis. The increase of mortality with age should be borne in mind in connection with operative procedures.

The principal cause of death was peritonitis. Of 32 deaths, 17 occurred within three days, due presumably chiefly to this cause. Six of these 17 cases, all gastric, died within 18°, while the shortest survival in the duodenal cases was 24°. I should take this as further evidence that gastric perforation is a more desperate condition than duodenal. Peritonitis as a principal cause was confirmed by autopsy in 5 instances. One case showed also lobar pneumonia, a second, dying on the third day, subdiaphragmatic abscess, and a third, clinically dying from diabetic coma, a chronic pancreatitis.

Three additional deaths occurred in the first week, and four during the second. Autopsy in three cases showed peritonitis; peritonitis and focal pneumonia; and in a case dying on the tenth day, subdiaphragmatic abscess with perforation of the diaphragm, right empyema and extension into the lower lobe of the right lung with abscess formation.

Of 8 cases dying after the second week, 6 developed subdiaphragmatic abscess as shown once by operation, and in the remaining cases by autopsy. Death occurred on the 16th, 33d, 38th, 40th, 44th, 54th days. Two cases were drained by operation, one case apparently recovering from the abscess after multiple operations when obstruction developed. In a third case, a resulting empyema was drained, but an undrained subdiaphragmatic abscess was found

at autopsy. In these 6 cases, there was an accompanying empyema in 3 cases, and an abscess of the lung in one, in two instances due to direct perforation of the diaphragm. Of the total 8 cases of subdiaphragmatic abscess, 6 followed duodenal and 2 gastric perforation.

The remaining two cases died on the 15th day, one of suppurative nephritis, the other of perforation of the descending colon with peritonitis.

It seems to me that the occurrence of subdiaphragmatic abscess is a matter of particular importance. It developed eight times in 32 cases, or in 25% of the deaths. It was only recognized clinically, and operated on in two cases, both of which ultimately resulted fatally. Extension of the process through the diaphragm occurred five times, in 3 cases by direct perforation. These facts emphasize the importance of careful study by clinical examination and x-ray in cases of unexplained temperature, and the necessity for exploration on the suspicion of abscess.

Of the 82 cases with diffuse peritonitis, 70 were treated by closure or drainage of the perforation alone, and 12 had a posterior gastroenterostomy added. Of these 12 cases, 4 gastric and 8 duodenal, 2 died, one from diabetic coma and one with delirium tremens. This would appear to give a lesser mortality to those cases in which gastroenterostomy was done, but it should be noted that these cases were favorable ones at the time of operation.

The cases treated by drainage or packing without suture showed a higher mortality than those closed by suture. Of course this was largely due to the employment of this measure in the particularly bad conditions where speed was important, or in perforations difficult of access, or having much surrounding induration. However, the difference is so great that I feel that even in such cases a greater expenditure of time and more manipulation is justifiable to secure good closure. The use of an omental flap sutured over the perforation may be important in this connection.

General irrigation with salt solution was employed in the majority of the earlier cases; its use in the latter cases was much less frequent. The impression given by this series is that the expenditure of time and increase of shock its use requires hardly justifies it as a routine measure. In this connection, culture of the peritoneal fluid obtained at operation is of interest. In 35 cases, culture gave a growth 7 times and no growth 28 times.

Drainage of the neighborhood of the perforation was almost universally employed. Judging from the results of culture of the peritoneal fluid, drainage might have been omitted in a larger proportion of cases. However, as it is difficult to tell at operation just in which cases it may be helpful, its use in so many cases, even if occasionally unnecessary, would at least seem

justifiable. A tube to the bottom of the pelvis through a supra-pubic stab-wound was used in a small proportion of cases. It is hard to estimate the effect of this measure. At any rate, it would seem advisable only in the case of a considerable collection of definitely purulent fluid in the pelvis.

The great question is, of course, whether gastroenterostomy is advisable as a general procedure. This will be taken up particularly in discussing the late results. As far as the immediate recovery from perforation is concerned, it is not obvious how a further employment of gastroenterostomy would have benefited the mortality. The cases did not die from inability of the stomach to pass food into the intestines. They died of shock and sepsis. In looking over the records, it is hard to see that the obstruction caused by infolding through suture of the ulcer excited any bad influence on the mortality. It may be argued that gastroenterostomy relieves tension on the sutured perforation, and so both lessens the danger of leakage and promotes healing. But if the perforation is reasonably well closed, the leakage does not seem likely to occur. It seems to me that the question of gastroenterostomy at the time of closure of the perforation is a question of its effect on the remote results of the operation to the patient, but not of aiding the immediate likelihood of recovery from perforation.

The question is, are the late results following the closure alone of perforated ulcers sufficiently good to make the additional time needed for a posterior gastroenterostomy an unnecessary risk? An attempt has been made to find out the late condition of the patients with especial reference to this point. The cases recovering from subacute perforations have been included, since the effect of perforation and closure on the gastric and duodenal wall should be approximately the same in either case.

Of the total cases surviving, 57 in number, 12 cases have no bearing on this question, since a gastroenterostomy was performed at the time of the primary operation. Of these 12 cases, 5 gastric and 7 duodenal, 8 cases have been heard from at periods of from one to eight years. Two gastric cases were both well. Four duodenal cases were well, one duodenal case when last heard from had recurrent haemorrhage beginning five years after operation, and one had died after 19 months apparently from urinary sepsis following stricture.

Of the remaining 17 gastric cases which recovered following closure or drainage without gastroenterostomy, 12, or 70%, have been heard from. Two cases have required a secondary gastroenterostomy, 1 at the end of two months, the other at the end of two and a half years. The first case required a third operation after 6 years, freeing of gastric adhesions. Both cases were well when heard from, 1 year following the last operation. Two cases had definite

gastric symptoms. One of these was strongly alcoholic, and died four years following operation. Six cases were free from gastric symptoms. One of these developed phthisis at the end of four years, dying eight years after operation. A second, after freedom from gastric symptoms for eleven years, developed an obstructive carcinoma of the esophagus, for which gastrostomy was done. Two cases at the end of three years were in fair health, but required limitations of diet. Thus, to sum up, 6 cases, or one-half, were apparently as completely relieved as they would have been with an additional gastroenterostomy; two cases, while not completely relieved, had tolerable symptoms, while in 4 cases, two of which required further operation, the late results were definitely bad.

Of 27 surviving duodenal perforations treated without gastroenterostomy, 20, or 74%, have been heard from. One of these cases had a second perforation three months following the first, at a point one-half inch distal to the original perforation on the superior aspect of the first part of the duodenum. A gastroenterostomy was done as well as closure, and the patient reported well two years later. Four other cases had a subsequent gastroenterostomy. One of these was done one month after closure by advice as a preventive measure, although the patient had no definite digestive symptoms. One case was free from disturbance for ten years, when he developed moderate digestive symptoms, for which appendectomy and radical cure of right inguinal hernia was done. Of the remaining 14 cases, 11 reported themselves well at periods of one to twelve years. Two cases had slight symptoms at the end of one year, and one case developed moderate symptoms at the end of five years of freedom.

To sum up, in these 20 cases, there was one re-perforation, four cases had a secondary gastroenterostomy, two cases had moderate, and two cases slight digestive symptoms, while eleven cases were apparently relieved following closure of the perforation. The results were apparently good in 11, or 55%, of the cases when heard from, and tolerable in 13, or 65%, of the cases.

In both duodenal and gastric cases, it is plain that a primary gastroenterostomy might have avoided a considerable number of secondary operations. At the same time, about one-half of the cases followed reported themselves well and free from symptoms. It is possible, of course, that symptoms may develop later in these cases. At the same time, as long as freedom from trouble persists for a considerable period in so many cases, it is well to be conservative in adding a method of treatment which prolongs considerably the time of the primary operation. It is not fair, either, to consider that an additional gastroenterostomy would give 100% of cures. There is no question but that gastroenterostomy may be safely added at the

primary operation in young people operated on shortly after perforation. Whether or not the added gastroenterostomy will unfavorably influence the operative mortality will depend on the surgeon's judgment in selecting cases, and his speed and skill in carrying it out.

The present series of cases suggests the following contra-indications to gastroenterostomy. It should not be performed in ulcers definitely gastric. The mortality of closure alone, 43.5%, is too high. In addition, closure of such ulcers is less likely to cause pyloric obstruction, and the benefit of gastroenterostomy is likely to be less marked than in ulcers of the duodenum.

In perforated duodenal ulcer in cases beyond middle age gastroenterostomy should be rarely added, since the mortality of closure of the perforation alone is high in cases at this time of life.

For the remaining duodenal cases, it is a matter of individual judgment. If there is the least question as to the patient's power of resistance to the peritoneal infection, it should be omitted, since he has at least an even chance of future freedom from symptoms without it. At the worst, it may be done as a secondary measure. It is true, that many people prefer to get along with discomforts rather than go to the time, trouble and expense of a second operation, and much might be saved in these cases. At the same time, the main aim should be reduction of the primary mortality, and other considerations should remain entirely secondary to this.

In conclusion, I should like to note the following points:

This series gives no evidence that pyloric obstruction is a factor increasing the primary mortality which might be avoided by an immediate gastroenterostomy.

Gastric perforations carry a distinctly higher mortality than duodenal.

The mortality of both gastric and duodenal perforations is high after middle life.

One-half the cases of perforation, treated by suture alone, were apparently cured following operation.

Therefore, an additional gastroenterostomy may well be avoided in cases of gastric perforation, in patients beyond middle life, and in any case where the general condition or elapse of time since perforation suggests possible death from peritonitis.

This series suggests, that for the average surgeon, at least, the rule should be to close the perforation, and the exception to add a gastroenterostomy.

DISCUSSION.

DR. I. J. WALKER (by invitation): In a previous paper on this subject, read before the Massachusetts Medical Society, June, 1915, I summarized and derived certain conclusions from a study of the cases from the surgical records of the Boston City Hospital from 1905 to 1914 inclusive. These were 78 in number. There have been 53 cases since then up to Jan. 1, 1917, making a

total of 131 in twelve years. A completed study of these cases has added really nothing new in the way of etiology and diagnosis of this condition. One hundred and twenty-two were males and 9 were females. The average age of the males was 34.25 years and the females 26 years. The youngest patient was seven years of age and the oldest seventy-one. The site of the perforation was in the stomach in 75, in the duodenum in 52 and at the pylorus itself in 4. In all except three the perforations of the stomach were found within two inches of the pylorus. In the latter the openings were near the cardiac end. The perforations of the duodenum were all upon the first portion and anterior wall except two, the latter being upon the posterior wall of the first portion.

It would seem that the most important point for discussion would be along the lines of treatment, which really narrows down to two questions. First, as to the necessity of drainage. It has been rightly said that drainage is not always necessary in those cases seen soon after perforation, since the contents of the stomach and duodenum are relatively sterile and what infection there is present will be cared for. In 34 cases of various duration, cultures were taken from the fluid in the peritoneal cavity, of which 14 showed bacterial growth and 20 were sterile. However, there is no way of determining macroscopically in a given case whether or not the fluid is sterile and, if not sterile, what may be the number and virulence of the organisms. In this series 6 cases were closed without drainage, with 5 recoveries and one death, the latter from general peritonitis. I think we must admit that while cases do recover without drainage the safest procedure would be drainage in every instance. Secondly, I wish to refer to operative measures in addition to closure of the perforation, such as gastroenterostomy. Theoretically, as in chronic ulcer, we should like to excise, cauterize or enfold the ulcer and do a gastroenterostomy in every case. Practically, however, this has up to now not seemed advisable owing to the condition of the patient or to the danger of spreading the possible existing infection. I think that we must all agree that gastroenterostomy becomes a necessity where the lumen of the pylorus or duodenum is narrowed as the result of closure of the perforation. In this series, and for this reason, gastroenterostomy was done in seven cases with a recovery in each instance. Gastroenterostomy becomes a matter of judgment in a small group of cases seen soon after perforation where the infection is slight and the patient in good condition. It is not a necessity in this group as we well know that patients recover with closure of the perforation alone. However, while we are quite sure that a certain number of patients are cured of ulcer symptoms by simple closure of the perforation, we are also sure that certain others have recurrence of their troubles. I am not in a position to give statistics on this question but hope to later when these cases have been followed up thoroughly. I do believe that the average surgeon will have a lower mortality in a large series of cases, by simply closing the perforation and later doing a gastroenterostomy, if necessary.

Results. There were 129 cases operated upon by 18 surgeons with a mortality of 34.3-8%. Two cases died without operation, the diagnosis being confirmed at autopsy. Five of the cases operated upon were practically moribund at the start and

died within two hours. The average duration of the perforation was 27.7 hours. Eliminating 12 who were operated upon more than 48 hours after perforation, we find an average duration of about 17 hours. Of 30 operated upon during the first four hours only one died. This death occurred on the sixth day after operation from a secondary hemorrhage in an arteriosclerotic individual. Of those operated upon from five to twelve hours after perforation, the mortality was 12.1%. Of those 13 to 24 hours after perforation, 36.3%. Of those 25 to 48 hours after perforation, 83.1%. Twelve were operated upon, in which the perforation had existed more than 48 hours, with five deaths and seven recoveries. Of those who recovered in this group it should be said that each had a walled-off abscess.

Conclusions. Simple closure of the perforation, with drainage of the peritoneal cavity is the safest procedure in the majority of cases.

Certain cases, who have recovered from perforation, are cured of ulcer by simple closure of the perforation. Unquestionably, others have recurrence of their troubles. It would be well that investigation be carried out in order to give accurate statistics in regard to the question of recurrence of ulcer following simple closure of the perforation. The mortality in cases of perforation can be greatly lowered by early operation.

DR. CHEEVER: I approve very heartily of Dr. Richardson's and Dr. Walker's disapproval of the routine performance of gastroenterostomy in operating for acute perforation of the stomach and duodenum, since it seems certain that, in serious cases, this would contribute to the mortality.

In this connection as tending to explain the comparatively low mortality in the gastroenterostomy cases reported by Dr. Richardson, I should like to ask him whether this procedure has not only been carried out on well-selected cases, but whether it has not been performed only in the most recent years and therefore under the most improved technique?

As to the comparative mortality of acute perforation of the stomach and duodenum, I wish to direct attention to the fact that the amount of extravasation, which must be a very important factor, is much greater in the gastric than in the duodenal lesion, the reason being that the peritoneal irritation of impending or actual perforation, according to all analogy, must cause a reflex spasm of the pylorus which prevents the escape of gastric contents and limits the extravasation to the comparatively scanty contents of the duodenum itself. No such mechanism exists evidently in the case of the gastric perforation. Moreover, my experience has been that gastric ulcers, as a rule, are larger than duodenal ulcers, which still further increases the tendency to copious escape of contents.

DR. JOHN B. BLAKE: About twenty-five of the City Hospital cases, almost all of them young or middle age men, came to the first Surgical Service. In a large majority of these a history of previous gastric disturbance was not obtained, unless eructations of gas alone are to be considered signs of definite stomach lesions. My impression has been that we are more apt to get a history of previous stomach trouble in cases more than forty years of age. It is somewhat puzzling to conjecture where these cases were ten years ago. They cannot be an entirely new development, yet they seem to me

many times more numerous now than formerly, and, as they present positive operative indications in almost every instance, we could not have missed them all even ten years ago.

I should like to congratulate Dr. Richardson upon an excellent and very thorough bit of surgical work; and Dr. Walker for a careful compilation of the Boston City Hospital cases.

Dr. E. P. RICHARDSON (closing): In regard to apparent stricture of the pylorus as an indication for gastroenterostomy, it seems to me that the matter should be judged not by the degree of constriction of the pylorus but whether the patient is likely to survive his peritonitis or not. If the patient gets over his peritonitis, there is time before he starves for further measures to avoid pyloric obstruction, either a secondary gastroenterostomy, or possibly a jejunostomy under local anaesthesia. My impression from from these cases is that food is more successful in passing the pylorus than one would judge from the condition found at operation. I think the question of gastroenterostomy should be judged from the probable outcome of the peritonitis and not from the apparent condition of the pylorus.

In differential diagnosis, the important question is whether there is a definite history of ulcer. An indefinite history of indigestion, which may come equally well from other conditions in the abdomen, does not help in diagnosis. It is very probable that many of these histories were inaccurately taken. The point which I wish to make, however, that there is a difference between gastric and duodenal ulcers in the frequency of definite ulcer symptoms, is sufficiently suggested by these cases, since any inaccuracies would presumably affect both groups equally.

In reply to Dr. Cheever's question, whether primary gastroenterostomies were not done in the later cases, while I have no definite figures, I feel sure that the majority were done in the past ten years. The description of the size of the perforation was so loose that I was unable to determine whether gastric perforations tended to be larger than duodenal.

Original Articles.

APPENDICITIS.*

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APPENDICITIS is like many other subjects in various fields of work in that the more we see of it, the less we know of it, or more properly speaking, the more we see of it, the more we realize that we are only learning about it. Said quickly, it sounds very common and uninterest-

ing, and suggests pain in the lower abdomen, vomiting, fever and tenderness. But said slowly and with reflection of past experience, we realize that appendicitis is much more than this, and the greater the experience, the larger the number of perplexities and mistakes.

The condition was first described by Heister in 1755, who noted while dissecting the body of a malefactor in November, 1711, "the vermiform process of the caecum preternaturally black and adhering closer to the peritoneum than usual."

The symptomatology was first described by Mestivier in 1759. A pint of pus had been liberated from the right lower quadrant by incision. The wound healed, but the patient died, and autopsy showed a gangrenous appendix containing a large, very rusty pin.

Mellier, in 1827, was the first to suggest that the condition was probably not rare,—that the appendix suppurated and bursted, and was the cause of abscess in the right lower quadrant. He failed to receive the glory which he deserved because Dupuytren, who was the great surgical authority of the day, strongly ridiculed his views. But to Mellier really belongs the credit of first formulating correct conclusions as to the existence of inflammation of the appendix in a chronic form, of recognizing the causal relationship between this chronic affection and suppurative tumors in the right iliac fossa, and of first suggesting the possibility of surgical interference.

Sporadic articles occurred in the literature from this time forward to the valuable contribution of Fitz in 1886. Fitz was the first to recognize that the various abdominal disorders known as perityphlitis, typhlitis, caecitis were but manifestations of primary inflammation of the appendix. He also was the first to urge very early operation, at least as early as the third day. His, furthermore, is the first publication in which the word *appendicitis* was used.

Hall of New York, on May 8, 1886, operated for strangulated hernia, and found the sac full of pus from a ruptured appendix. This he tied off and removed; then, through an enlarged incision, manually explored the abdomen, breaking up adhesions and emptying pus cavities. The patient recovered. This is the first case of perforative appendicitis successfully treated by laparotomy and removal of the appendix.

On April 27, 1887, Morton of Philadelphia successfully removed an appendix and drained the abscess. The preoperative diagnosis, however, was intussusception, or perityphlitic abscess. The first case in which a preoperative diagnosis of appendicitis was made and operation successfully done for its relief was by Sands of New York, on December 30, 1887. The patient made an excellent recovery.

So much for a brief résumé of the history of the subject. Let us now consider more particularly the signs and symptoms of acute and chronic disease of the appendix.

* Read before the Middlesex East District Medical Society, Nov. 8, 1916.

At the outset, you will agree with me that there are so many exceptions to what we may call a "type case," that it is impossible adequately to cover even this part of the subject in the time at my disposal. I have, therefore, elected to recite cases in my own experience in private and hospital work, cases which stand out in my mind as illustrative of some particular variation or departure from the usual.

The most constant and valuable symptom of acute appendicitis is pain. Usually the pain is at first quite general in character, and usually colicky. Later it is usual for the pain to become localized in the right lower quadrant, and to become more constant in nature. There is not infrequently a history of several days of lassitude, or headache, or slight digestive disturbance, especially constipation. There may, however, be no antecedent indisposition, but the onset may be with overwhelming suddenness. Again, it may be insidious, manifested only by dragging in the right lower abdomen, and this nagging may be followed without other warning by chill and prostration from rupture.

I recall a young college student of twenty, who for a fortnight experienced pulling in the right lower quadrant when walking fast or carrying a suit-case. One day, this pulling was evident when getting up from a chair, but not exquisite. In fact, that night he played water polo in the tank in his dormitory. On going up to his room, he was taken with violent rigor, and at operation showed a ruptured, completely gangrenous appendix.

Again, the pain may be in the lower chest, more especially in the back. The temperature may be high, white count high, respiration rapid. This picture is not uncommon in children, and may be confounded with pneumonia. The converse is, also, true. Cases of pneumonia may be diagnosed appendicitis. The nature of the pain is not surprising when we remember the distribution of the lower intercostal nerves on the abdominal wall. Regarding the shallow respiration, I think it is important to note whether the respiration is thoracic or abdominal. If either region is splinted, *i.e.*, held still, it is the affected region. Therefore, in these confusing cases, if the respiration is chiefly thoracic, the pathology is probably intra-abdominal, and vice versa.

Again the pain may be well around in the flank, or even in the right upper quadrant. You will recall that the large bowel develops chiefly in the left of the belly,—that the part which is destined to be the caecum first passes upward, then to the right, and finally downward into the right iliac fossa. This is known as the rotation of the large bowel. The phenomenon may be interrupted at any point. The caecum may never leave the left side of the belly, but this is very rare. But it is not very rare for it to remain in the right upper quadrant. Consequently, an acute appendix in this situation may simulate cholecystitis.

On account of the possibility of undescended caecum, I believe it is a good plan to make the incision for appendectomy in children a little higher than in adults, in those cases where the spasm is pretty general throughout the right side and there is no guiding mass. I commonly use a right rectus incision about two and one-half inches long, with the upper end at, or a little above, the level of the umbilicus. If the appendix is in normal position, it can be readily reached because the thin belly walls permit retraction. If the caecum is undescended and the appendix is high, only slight lengthening of the incision upward may suffice, and the resulting wound will still be small. If a low incision has been practised, great extension of the cut upward may be necessary, or even a second higher incision.

As an illustration of the advantage of this high incision: A boy of nine, who had been ill several days with fever, right-sided abdominal pain, and vomiting. His belly was like a board throughout the right side. A diagnosis of ruptured appendix was made. The abdomen was opened through a right rectus incision at the level of the umbilicus. The right iliac fossa and pelvis were bathed in foul pus. No inflammatory mass could be felt, nor any large bowel seen. Following upward, a cake was felt beneath the liver well in the flank. The wound was enlarged upward. Pus was seen coming down along the flank from this mass. A gangrenous appendix was liberated and with very great difficulty ligated and removed. Drains were placed above, to the side, and to the pelvis. The boy, although desperately ill, made an uneventful convalescence, and was discharged with a solid wound only about three and a half inches long.

At this juncture, let me cite a case recently operated upon through the kindness of Dr. Sopher. It is apropos of not finding the caecum in the iliac fossa, but for another reason. The patient was a girl of nine. The abdomen showed no guiding mass. I had made my usual incision. No inflammatory mass could be felt. The sigmoid presented. The ascending colon and caecum were not evident. The possibility of non-descent of the caecum directed me to feel upward in the flank. There the upper part of the ascending colon was encountered coming up from beneath a tough sheet of membrane. The lower one-half of the ascending colon and caecum lay plastered down against the posterior abdominal wall by this membrane, and were as much retroperitoneal as the lower part of the duodenum. A vertical incision was made through this, the caecum mobilized, and a curled-up, swollen appendix liberated. Despite the unavoidable handling of bowel, her convalescence was practically free from gas.

The caecum in one of the subjects in my section in anatomy this year is very high. The terminal six or seven inches of ileum ascends

from the pelvis to join it, and is held to the posterior parietes without any mesentery.

Pain is the most constant and reliable symptom of appendicitis. Muscle spasm is the most constant and reliable sign. Naturally it is most valuable when unilateral, and especially when it is more or less confined to the right lower quadrant. We must distinguish between voluntary and involuntary spasm. In order to differentiate, we must get the confidence of the patient that we will not hurt him. This is especially true in children and in nervous adults. It is well that the hands be warm, so as not to chill the abdomen. It is well to begin the palpation in some other part of the abdomen. It is my practice at first merely to lay the whole hand gently against the belly, using only slight pressure, beginning in the left upper quadrant, passing down to the lower quadrant, and then in the right upper quadrant passing down to the lower quadrant. By this procedure, we may learn whether the abdomen is soft or tense or rigid, and where tenderness is greatest. Having assured the patient of our gentleness, begin in the left upper quadrant again and pass around as before, but this time pressing a little firmer and with the flat of the fingers instead of the whole hand. Talking to the patient to distract his attention, having the legs drawn up or the mouth held open, ostensibly to look at the tongue, will aid in relaxing the abdominal muscles. Having found the area of greatest resistance, press in steadily and firmly, noting how deep the palpation can be carried with the patient's attention distracted. If true involuntary spasm is present, unabating resistance will be encountered, with a greater or lesser degree of pressure in a given case. As a concluding manoeuvre, place the flat of the fingers of both hands over the area under suspicion and make a sudden inward thrust. If true spasm is present, the thrust will be checked with sudden setting of the muscles.

The abdomen of a patient with simple belly-ache, green-apple colic, may show tenderness to pressure and, therefore, more or less voluntary spasm; but the longer gentle palpation is continued, the softer the belly will feel. There will be no true muscle spasm.

The abdomen of a patient with intestinal obstruction may be much distended and very tense, so that it feels firm, but the longer gentle palpation is continued, the softer the belly will feel. If there is no concurrent peritonitis, there will be no true muscle spasm. The distinction between firmness from tenseness and firmness from rigidity is most important.

The area of spasm may be great or quite small, it may be elicited with a variable degree of pressure, but will always be present in acute appendicitis. The more acute the infection, the more evident the spasm. An old abscess in which the virulence of the organism is attenuated may be protected by much less spasm than an acute unruptured appendix. Cases of severe

lead poisoning may offer perplexity. Cases of poliomyelitis, in which there is a peculiar selective involvement of the lower intercostal nerves, may offer perplexity. Cases of typhoid fever may offer perplexity. Maurice Richardson has written in his clear manner on this subject, and has recorded a number of illustrative cases from his large experience. Although typhoid fever is not nearly so common now, it should always be borne in mind.

The neglected cases, with huge, walled-off abscesses, are now seldom seen. The records at the Children's Hospital for the last twenty-four years show only two cases pointing at the umbilicus,—one operated upon by Dr. Cushing in 1895, and one by Dr. Lovett in 1899. However, the possibility should be borne in mind.

Only a fortnight ago, I saw in the Out-Patient Department of the Children's Hospital a girl of three with a temperature of 102, who had been ill for *three months* with abdominal tumor, constipation, and frequent and painful urination. She had been at another institution where diagnosis of inoperable tumor had been made. She showed a sharply bulging prominence at the umbilicus, tender and rounded. Palpation revealed a deep mass extending downward and more to the right than left. I admitted her with conservative diagnosis of abdominal abscess, considering the possibility of appendix abscess or infected cyst of the urachus or suppuration of a Meckel's diverticulum. Dr. C. G. Mixer, who was on house duty at the time, found at operation a huge, stinking abscess the size of a grape-fruit, presumably of appendiceal origin. Culture of the pus showed *B. c. communis*.

A rectal examination should *always* be made. A vaginal examination should be made in appropriate cases. In cases with low lying pelvic appendices these examinations may disclose resistance and tenderness, or even a mass,—invaluable information which may be ascertained in no other manner.

Later I wish to consider the differential diagnosis between appendicitis and ureteral stone. Our genito-urinary confrères hold that cases in which appendectomy has been done but pain persists, are always cases of unrecognized ureteral stone. On my last service in the Surgical Out-Patient at the Massachusetts General Hospital, I saw a case in consultation with the visiting man on the medical service. It was a question of ureteral stone or pus kidney. The appendix had been removed a year ago. Pain had been present in the right abdomen for a week. The scar showed no hernia. There was no spasm in the back, over the kidney, or beneath the scar, but low in the right lower quadrant towards the median line. The temperature was 101. A rectal examination discovered a huge prostatic abscess, more on the right side. I cannot too strongly emphasize the value of examination by rectum.

The chronic appendix may cause trouble in

two ways. In the first place, from previous inflammation, it may be partly occluded or kinked, so that it is prone to acute exacerbations. Secondly, it may cause trouble mechanically through adhesions to different structures, —the bowel, the female adnexa, the bladder, the ureter. Such adhesions may exist without causing any symptoms. Others may be responsible for digestive, urinary, or menstrual symptoms.

I note that Dr. James Jackson is to read, at your next meeting, on intestinal adhesions. I shall, therefore, merely touch on this phase of the subject in this paper from a surgical viewpoint.

The most marked disturbance I have ever seen from chronic appendicitis occurred in a young girl who displayed all the signs and symptoms of intestinal obstruction, with the addition of acute inflammatory trouble in the right lower quadrant. Operation showed all the small bowel tremendously distended, free fluid in the abdomen, and a long, chronic appendix caught down firmly across the terminal ileum, and acutely inflamed. She had had definite attacks of appendicitis in the past, but why she had not had more disturbance from partial obstruction before this acute attack, I do not know. The operation was difficult, but has given entire relief. Such marked disturbance from appendiceal adhesions must be very rare. Usually, the disturbance is less definite, and frequently offers some of the most difficult problems in diagnosis.

The adhesions about the caecum may result in incompetency of the ileocaecal valve. Associated with this, there may be vague digestive disturbance, which gradually reduces the general health, may lead to lassitude, tired-out feeling, disinclination to exercise, general loss of muscle tone, poor posture, and ptosis. Once this has occurred, the patient will suffer more from the sequelae of the adhesions, particularly the ptosis, than from the adhesions themselves. With the ptosis, there may be angulation of the bowel, loss of muscle tone, stasis, constipation, and absorption. I believe that the damage to various tissues from intestinal absorption has been exaggerated, but there can be no doubt that the interference of so important an excretory system must certainly be harmful to the individual from absorption of effete products. But this leads us beyond the domain of this paper.

Again, adhesions about the region of the caecum provoke secondary gastric disturbances. The most profound cases of hyperacidity which I have seen were both in young men with chronic appendices, adhesions of the right iliac fossa, and incompetent ileocaecal valves. The history of such cases may be suggestive, but the only reliable evidence is gained by x-ray examination. Here again, I believe that the pictures of the meal in different parts of the gastro-intestinal tract may be suggestive, but do not warrant in the majority of instances positive statements regarding the mobility of the intestines.

It is to be remembered that such plates indicate the position of the bowels only at one given time. The position of the bowels at this time may look queer, but it cannot be said that this position is permanent. The only certain method is by the fluoroscopic screen, by which method the position of the bowels may be observed for a considerable time with the patient standing and recumbent. Furthermore, palpation may be done with the patient on a fluoroscopic screen, and any binding together of coils of bowel may be determined. The bismuth or barium enema with fluoroscopic examination usually gives more valuable information in regard to appendiceal adhesions than taking by mouth.

Roentgenologists not infrequently have unwittingly led us astray. I think it is well for the surgeon to be present at the fluoroscopic examination, not to oversee the work of the roentgenologist, but to aid him by friendly discussion of points as they present themselves.

Organic disturbance of one part of the gastro-intestinal tract may lead to functional disturbance of another part of the tract. I believe that this secondary disturbance of function in another part of the tract may in time in some cases result in actual organic trouble. We are all familiar with the frequency with which chronic appendicitis and chronic cholecystitis, with or without gallstones, is met. The multiplicity of lesions of the gastro-intestinal tract is to be borne in mind.

In cases with gastric symptoms, which show by fluoroscopic examination undoubted adhesions in the region of the caecum, I think it is well, therefore, to investigate the gall-bladder. I have twice failed to do this, and in both cases the gall-bladder has been the cause of subsequent trouble. In both cases, however, the removal of the appendix and freeing of caecal adhesions was but a small part of the operating, one having in addition a total hysterectomy, with resection of upper third of the vagina. It would have been unwise to have attacked the gall-bladder in these cases, but they illustrate the necessity of not laying too much stress on adhesions in the right lower quadrant from chronic appendicitis.

Urinary symptoms due to retrocaecal appendices, adherent over the course of the ureter, require much study. In May, 1913, your president kindly referred to me a case with a diagnosis of appendicitis. The attack was a mild one. The pain was well in the flank. Routine examination of the urine showed pus. X-ray showed a shadow in the course of the lower ureter on the right, presumably a phlebolith, but possibly a ureteral stone. Cystoscopy showed pus coming from the right ureter. A ureteral catheter, however, met no obstruction. This determined the location of the incision. The abdomen was opened with the ureteral catheter in place, and a long, firmly adherent chronic, retrocaecal appendix with recent, acute exacer-

bation was found lying over the ureter. It was removed with difficulty. Whether or no this colon infection of the right kidney was due to this firmly adherent appendix or to haemotogenous infection, the diagnosis of appendicitis was correct.

Another perplexing case was a doctor seen in June, 1916, kindly referred by Dr. MacDonald of Meteghan, Nova Scotia. As a boy, the patient had suffered greatly with what was called indigestion. Four years ago, he was seized with so violent a pain in the right flank, mid-way between the crest of the ileum and the costal margin, that he sank to the ground and writhed in agony. The pain subsided in about a week. A month ago, he was seized with a similar but milder attack, and pain and soreness have persisted. In Halifax, the urine was found to contain microscopic blood, and a diagnosis of ureteral stone was made, for which he was referred to me. Mindful of Dr. Heath's case above related, and of the past history of indigestion, I told the doctor at the first examination of the possibility of a retrocaecal appendix adherent over the ureter. X-rays for stone by Dr. Walter Dodd were negative. Ureteral catheterization and injection of renal pelvis by Dr. Arthur Crosbie were negative. Fluoroscopic examination showed beautifully the caecum descending only part way, when in upright position, and then evidently somersaulting over a fixed point where there was a small shadow, presumably the partly filled appendix. A very difficult appendectomy was done. The appendix was fully five inches long, entirely retrocaecal, and applied firmly over the ureter to the lower pole of the kidney. He is absolutely relieved of his symptoms.

Operations for chronic appendicitis should not be done without very thorough preoperative investigation, there are so many other pathologic conditions in the right lower quadrant whose symptomatology closely simulates chronic appendicitis,—Jackson's membrane, ptosis, caecum mobile, ureteral stone, adnexal disease, tabes mesenterica, chronic intussusception, concealed herniae, unduly tense psoas fascia, early malignant disease and tuberculosis of the caecum, Lane's kink, and developmental anomalies of the bowel, ureter, and genitals.

Occasionally a patient is seen for the first time who presents a definite appendix cake, and who is evidently getting better. I believe under certain conditions in such cases it is well to defer operating. This is true if the patient has some serious cardiac or pulmonary condition, is greatly debilitated, or has some serious constitutional affection, such as advanced nephritis, diabetes, exophthalmic goitre, etc. Of course, if this plan is pursued, the patient should be under close observation, preferably in a hospital, so that immediate operation may be done, if necessary. A four-hourly pulse and temperature chart and a bi-daily white count chart should be kept.

Let me say here that I think it is very dangerous to decide for or against operating on a single white count determination. During this period of waiting, the appendix cake is becoming more definite and, should operation later become necessary, it may be a much shorter and simpler matter than when first seen. In fact, it may be done with very little, if any, handling of the intestines, which is a great desideratum in debilitated patients.

Another class of patients in which watchful waiting is justifiable is the bleeder.

On August 11, 1913, I operated upon a young man of twenty-five, upon the third day of a definite attack of appendicitis. A right rectus incision was made, and there was such general oozing that attempt to clip individual vessels was not made, but a piece of gauze was placed either side of the wound and held by retractors. The appendix was retrocaecal. The caecum was lifted into the wound gently with a wet sponge, and immediately there suffused through its walls beneath the serosa a considerable haemorrhage. A few fresh adhesions were broken and an old band clamped and cut. The meso-appendix was clamped and cut. Oozing had been continuous, and by this time, the whole lower quadrant was a pool of blood. This was sponged out, the clamped vessels tied, and a couple of interrupted sutures, placed to the mesentery, but still the oozing was smart. However, the gall-bladder, duodenum, and pylorus were palpated. The abdomen was closed in layers, requiring continuous sponging. Everything bled,—every stitch hole was a new bleeding point. Anticipating a haematoma in the wound, a pad of several pieces of gauze was placed firmly against it with several strips of adhesive. The next fourteen hours were uneventful. The following twenty-eight hours were very stormy. During this time, he vomited five times. The vomitus was like that of peritonitis,—thin and dark brown, but expulsive rather than of overflow type. During this time, there were seven movements, some voluntary and some with enemas, all of which contained old blood.

Removal of dressing revealed the incision elevated on a rounded prominence about five inches long, two and one-half inches wide, of purplish-blue color and firm consistency, evidently a massive hematoma. Ecchymosis extended from this into the flanks, and during the next few days downwards onto the penis. He was up and about the room on the twelfth day and discharged on the fourteenth day.

Just before discharge I obtained the following history: About three or four years ago, after the extraction of two or three teeth, bleeding continued for three days despite several trips a day to the dentist. Two years ago he fell on the ice, splitting open the tip of one of his fingers about one-quarter of an inch. This bled for days despite bandaging, and stopped only after suturing. If he cuts himself shaving he may be prevented from going to business.

This case I placed on record as a reminder of this as a serious surgical complication, and as a reminder of what I believe very common negligence,—failure to make inquiry about bleeding in obtaining the history, especially in acute conditions.

The cases in which watchful waiting is justifiable, however, are the exceptional cases. The vast majority had better be operated upon as soon as the diagnosis of appendicitis has been made.

We have all seen fulminating cases in which the time from the first pain to perforation was only a few hours. There is, moreover, no way of predicting what case will subside and what will proceed rapidly to rupture. There is no symptom-complex which will with certainty indicate the amount of injury under which the appendix is laboring; no symptom-complex which will with certainty indicate whether or not rupture is impending.

I recall a well-built, healthy-appearing young man, kindly referred by Dr. Wells of Wakefield. His pain had begun late on the previous afternoon. When seen about eight in the morning, April 27, 1916, he was more comfortable. The belly was perhaps a little distended. There was spasm in the right lower quadrant only upon quick, deep pressure. He did not look seriously ill. He was moved at once to the hospital, and within an hour, he was on the operating table. I found a large appendix, completely gangrenous at the base, the head of the caecum gangrenous, and fees free in the iliac fossa. The appendix was removed, the hole in the caecum trimmed and infolded, and wicks placed to the appendix site and pelvis. A fecal fistula developed, as was expected. The wicks were left in place until a definite sinus was established. The fistula promptly closed, and he left the hospital in one month with a small, granulating wound.

Another experience occurred on a Sunday in June, 1912. At nine a.m. I saw an instructor at Technology for an older surgeon who was out of the city for the day. He was taken with pain on the previous afternoon. He had had a wretched night. I spent two hours trying to locate the surgeon, only to learn that he had gone yachting. I saw the young man again. He did not look like the same patient. He was then desperately ill, with a belly of board-like rigidity. In an hour he had been moved to a hospital. His temperature was only 99, his pulse 140. On opening the belly, no adhesions were found. The bowels were bathed in thin mouse-colored pus. The appendix was half gangrenous. It was quickly removed and drains placed. His convalescence was very slow and complicated by a pyelitis.

These two cases are valuable lessons. I could cite others, and you all could add still other cases. They teach us that "appendicitis is a treacherous disease, that it may be insidious in its manifestations, uncertain in its course, and

liable to sudden changes, which may at any moment put the patient in a condition of extreme peril."

The wider the experience of the surgeon in dealing with appendicitis, the less confidence will he have in formulating any definite conclusions regarding the interpretation of its individual symptoms, and particularly concerning their prognostic value.

It has been often said that the best place for an inflamed appendix is in a bottle, and it may be added that, with but few exceptions, the sooner it is in the bottle, the better.

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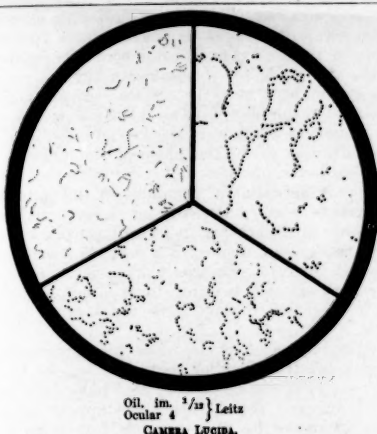
Clinical Department.

A LABORATORY AID IN THE DIAGNOSIS OF SCARLET FEVER.*

By D. M. LEWIS, M.D., NEW HAVEN, CONN.,
Epidemiologist to the Board of Health.

DESPITE lack of knowledge of the causative organism of this disease, I have found that cultures from throats may give, frequently, the same aid that we have in diphtheria. Whether any certain streptococcus is the secondary invader or not, I submit the following facts to prove that a certain streptococcus, morphologically, gives reliable data. The accompanying illustration is a camera lucida drawing by Mr. Kellner of the Yale Clinical Laboratory, show-

* Paper read before the Eighth Sanitary Conference of Health Officers of Connecticut.



ing in the lower third the usual streptococcus seen in throat cultures, that on the right third the streptococcus that aids us in scarlet fever while that on the left is one that has been of aid in measles. I offer neither name nor other characteristics of this streptococcus, basing its use on pure morphology, a procedure analogous to diphtheria, on the basis of my extended observations.

With unflinching confirmation during a period of ten years that a certain morphological streptococcus in milk sediment work meant garget, irrespective of the number of accompanying pus cells (an experience of upwards of 40,000 milk samples), as contrasted with other forms of streptococci with similar amounts of accompanying pus cells, I became interested in the streptococcus forms in throat cultures and especially in this one I shall term S for convenience. Its infrequency and its presence during the fall and winter gave me the following data over the period mentioned:

October, 1914, of 476 cultures, 11 positive; 2 were later reported cases.

November, 1914, of 790 cultures, 11 positive; 1 was a later reported case.

December, 1914, of 631 cultures, 6 positive.

January, 1915, of 579 cultures, 12 positive.

The following case reports are those previously mentioned:

CASE 1. Female, age 4. Clinical diagnosis was diphtheria, but 2 consecutive cultures show the streptococcus S, and the third day the eruption was present. The clinical course was that of a severe and protracted scarlet fever. The especial interest in the case was that the child had been in the charge of a trained nurse for one week during the absence of the mother and that the child and nurse had been absolutely alone during that time. The previous history of the nurse showed that immediately previously she had been in charge of a scarlet fever patient in a neighboring town; that she

had had a mild sore throat during the last week of attendance on the case, but that the family physician had given her a physical examination as well as the assurance that with a full bichloride bath she would be a perfectly safe individual to care for any well child. A culture at my request was taken from the nurse's throat and showed the streptococcus S. A physical examination showed a sub-acute throat, a strawberry tongue and fairly diffuse body desquamation.

CASE 2. Male, age 14. Clinical diagnosis diphtheria; throat culture streptococcus S. Diagnosis of scarlet fever offered to the attending physician, who two days later on the appearance of the eruption reported it as such. The interest in this case was that it led me back to this boy's chum, a reported case six months previously who, as described in my article on "Control of Scarlet Fever," under Case 2, was responsible also for 2 secondary cases. On both occasions this carrier showed the streptococcus S.

CASE 3. Female, age 18. Patient was seen having a chill at the time of quarantine of reported case of a brother. Throat culture showed pure streptococcus S. Patient later developed the typical signs and was a reported case.

Of even greater value than its use in diagnosis of primary scarlet fever during the past two years have been the data obtained as to carriers. The following cases are illustrative:

CASE 4. Male, age 6. Throat culture during an attack of sore throat in 1914 showed the streptococcus S, and the attending was advised accordingly. At the end of one week I was told that there had been no further evidence of the disease. One year later a culture taken at the time of a tonsillitis and endocarditis showed the same streptococcus. At this time I was told by the family that the boy had had scarlet fever three years previously under the care of another physician. My records showed that with 2 reported cases in males of the same age, both playmates of this boy some two weeks after the initial culture in 1914, that he was an undoubted carrier at that time.

CASE 5. Female, age 20. This case was related at length in my article on "The Control of Scarlet Fever" as Case 8, and is again quoted for the reason that an initial culture of this case admitted as a diphtheria, showed a pure culture of the streptococcus S, leading me to suspect her as a case of scarlet fever rather than the carrier that she proved to be.

Of more importance than mere relation of cases, I wish to show the value of cultures in the study of an epidemic in a neighboring sanatorium that I made in the latter half of 1914. The history of the epidemic in the words of the superintendent is as follows:

CASE 1. A man in the infirmary went to the dentist's July 25th; developed tonsillitis on the 28th. After being ill two days with tonsillitis developed typical scarlet fever rash on the 31st. He had been treated by my assistant, Dr. P. On the 31st Dr. P. developed his initial sore throat, as

did two other patients, a woman in the infirmary and a little girl in the children's ward. At this time within three days we had a total of thirteen cases develop: one, my assistant, one maid from the help's quarters, one from the men's side of the infirmary, two from the women's side of the infirmary, six from the girls' side of the children's pavilion and two from the women's cottages.

Ten days later there were two more from the women's cottage.

Three weeks after the first case developed and about two weeks after the last of the first series, a three-year-old boy in the children's pavilion developed. He had been in close proximity to the girls first affected. At the same time the nurse in charge of the isolation developed symptoms. She had had scarlet fever once before, several years ago.

Three weeks to the day after this and six weeks after the development of the first case, a case developed in one of the men's shacks.

It was at this time that we got you up. You isolated one boy from the children's pavilion whose throat culture proved negative and who never developed any symptoms. You isolated one whose throat culture was positive and who developed well-marked scarlet fever. You isolated one whose throat you reported negative, but who next day had a well-marked rash and typical symptoms. We had, therefore, at this second outbreak one man and the two boys from the children's pavilion.

On examining the patients, you isolated six suspects. In three of these the culture was positive. One of these had been in the Sanatorium since May 14th; a few days after admission had been laid up with a severe follicular tonsillitis. Ever since this time he had had a superficial ulcer at the margin of one of the tonsillar crypts and a slight persisting inflammation of the crypt. He had a tuberculous larynx. His throat was sprayed twice daily and the crypt had been treated from time to time. Two days after your first culture from his throat, I took a second culture, this time direct from the ulcer on the tonsil. This was positive. At the end of two weeks, after having the throat treated with 50% argyrol, and after using trichloroacetic acid a couple of times on the ulcer, we sent another culture to you. This culture was still positive, though that in the other isolated cases was now negative. At the end of three weeks we sent a fourth culture to you, which was negative. We had in the interim continued to treat the ulcer locally with trichloroacetic acid. With the isolation of this case and the two other suspects the epidemic stopped and we have had no further trouble.

Although this epidemic was studied only after some six months of observations on scarlet fever as described in my article on "The Control of Scarlet Fever," I felt secure enough of my grounds to try my procedures out where the usual routine of quarantine and fumigation had failed. With a physical examination of the tongue and throat of every individual on the premises, approximately 150, I took throat cultures from all hyperemic throats, some thirty-five in number, and of this number had those isolated whom I believed might be carriers from the appearance of the tongue as well. Among the children I

found two cases of the disease, isolating as well one boy with a possible scarlet fever throat. Two of the staff members numbered the culture slips and made for themselves a key record of these numbers and the names corresponding. The following day I gave them the record of the numbers which were checked on their list and in turn was given the physical examination I had made the previous day. It will be seen that by the combination of examination and cultures, I had as exact knowledge as I have claimed possible in diphtheria. Cultures proved one of two fresh cases, disproved a possible fresh case, proved three of six suspected carriers. On the strength of the cultures these other suspects with negative throats were freed from isolation.

Based on such evidence as the foregoing, I began the treatment of control of scarlet fever in exactly the same manner as I have described in a previous article, using the appearance of the streptococcus S as a cause for search for either acute cases or carriers depending upon the field investigation. During the year and a half employed, it has proved its value most exactly.

CANCER OCCURRING IN ACID PARTS OF THE BODY.

By A. L. BENEDICT, A.M., M.D., BUFFALO,

Consultant in Digestive Diseases to Columbus Hospital; Attendant, Mercy Hospital; Editor "Buffalo Medical Journal."

SOME years ago I published a statistic article showing the predominance of cancer in parts of the body having an acid secretion or especially liable to acid fermentation. It may be frankly admitted that this was prompted by the theory, somewhat in prominence at the time, that cancer was due to a yeast cell; but the statistics were given for what they were worth, without committing to the acceptance of this theory, and with due regard to the possibility that other conditions, such as mere mass of epithelium or special liability to mechanic and other irritating factors, aside from acidity, existed.

The latest large statistics available are those for the United States for 1914. They apply to the registration area and include malignant tumors in general, the error from the inclusion of sarcoma and the rarer malignant tumors, being small and probably self-neutralizing. Out of a total of 52,420 malignant tumors, the following may be tabulated:

Buccal cavity	2,270
Stomach	12,768

Rectum	2,171
Uterus	7,470
Vagina and vulva	184
Kidneys and suprarenals	538
Prostate	784
Bladder	1,014
Breast	5,423
Skin	1,957

34,579

In the case of the uterus and breast, it is obvious that some cancers may be primary in parts not reached by the acid vaginal secretion and perspiration, or foci of fermentation at the nipple. Suprarenal tumors should be subtracted, but are small in number. On the other hand, we have 6,458 tumors of the liver and gall-bladder. Most authorities hold that the great majority of the former are secondary to those of the stomach, and the latter develop in gall-bladders more or less subject to bacterial involvement. Four thousand and fifty-one intestinal cancers are listed. As various critical statistics show that only about 10% of all intestinal cancers develop between the portion subject to irrigation by acid gastric juice and that subject to acid fermentation, it is obvious that this large number must include many belonging in the latter group—indeed, it is obvious at a glance that it is impossible that 2-3 of the total intestinal cancers should lie above the rectum. It is, if anything, an understatement to say that 3,000 of the liver and gall-bladder cancers and 3,000 of the unspecified intestinal cancers should be added to the above table, making the total above 40,000, well above 75% and close to 80%, involving epithelium more or less exposed to some form of acid reaction. Without attempting to promulgate a new theory, this fact is worth consideration, especially in the present uncertain state of our knowledge of the essential nature and cause of cancer.

New Instrument.

AN IMPROVED VENIPUNCTURE NEEDLE.

BY GUY G. FERNALD, M.D., CONCORD, MASS.

THE *Journal of the American Medical Association*, August 26, 1916, p. 1107, presented an illustrated description of the Brandeis needle for venipuncture. It will be found in practice that a slight modification of this needle is an improvement.

The needle consists of a straight steel tube 6 cm. long, provided at about the middle of its length with a tab or flange of braized-on metal. When collecting sera this projecting flange is

seized in a long-handled hemostat or in a needle-holder or other selected lock-handle instrument which, together with the sterile and cotton-stoppered tube, is held firmly in the operator's hand. Ease and competence of grasp and certainty of direction for the needle are insured by this means provided the metal flange of the needle is correctly corrugated to fit the corrugations of the needle-holder jaws. With this instrument the uncertainties of venipuncture are practically eliminated.



In operating for the administration of solution intravenously by gravity or other positive pressure methods the same happy results are secured by using a special needle-holder with the jaws adapted to hold securely the female coupling of one's favorite needle. The advantage of any straight needle over any curved device is obvious to experienced operators; the lumen of a curved needle cannot be kept clean and polished by vigorous use of the obturator, while that of the straight needle may be.

Incidentally these needles may be conveniently cleansed and sterilized between punctures by using the obturator consistently after each flushing-out with sterile water and alcohol alternately. Wash bottles with adapted nozzles will serve the purpose. Merely immersing a needle in a solution is much less likely to insure asepsis than is the vigorous flushing and polishing with obturator above indicated.

A simple expedient, by no means in general use, is the overfilling of the veins of the arm on which venipuncture is to be done by having the patient sit or lie and thrust one hand and one arm down vertically while the other is thrust upward in the same direction. When after a few seconds, the tourniquet is applied over the biceps of the dependent arm, the operator has availed himself of the action of a simple law of hydrostatics and has a well plumped-up vein to operate upon.

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126 Massachusetts Ave., Corner Boylston St., Boston, Massachusetts.

THE MEDICAL PROVISIONS OF THE YOUNG BILL.

GOVERNOR McCALL, in opening his Annual Message to the Legislature, devoted an extensive section to Health Insurance, recommending definitely the establishment of a compulsory system of health insurance in this Commonwealth. This recommendation insures the serious consideration of the subject by the Legislature and by the people of this State. In line with the Governor's recommendation, Representative Benjamin Loring Young, of Weston, has introduced a health insurance bill, on the petition of members of a voluntary committee, which has been at work on the matter for some months, Dr. Roger I. Lee of Cambridge, Dr. Wade Wright of Boston being the medical members; Mr. Michael M. Davis, Jr., of the Boston Dispensary, being chairman. The Young bill, of course, entirely supersedes the Doten bill, printed in this JOURNAL on December 7, 1916, and no further study or consideration need be

given to the earlier measure. Physicians and medical societies throughout the State should study carefully the provisions of the Young bill, which is printed on pages 179 to 186 of this issue of the JOURNAL.

Previous to introducing the bill, the local committee had, of course, opportunity to use the drafts made in New York and by the Committee of the Massachusetts Medical Society, as reported in the JOURNAL editorial on January 11; and held many conferences with physicians in Boston and vicinity. The general system of medical organization for the care of the sick under the Young bill is the "panel of physicians." Every physician licensed to practise under the laws of the Commonwealth may enter the panel of his district by registering with the State Commission. Freedom of choice of physicians by patients is guaranteed, subject to the right of physicians to refuse patients on grounds to be specified in regulations under the act. Medical attendance to dependent members of the families of insured persons is included in the Young bill. A provision of the Doten bill, that salaried physicians be allowed, has been modified, evidently in the endeavor to eliminate the evils which might arise from an extension of the salary system. It is provided that the State Commission, with the approval of the Medical Advisory Board, may permit (in combination with the panel system) the employment of legally qualified physicians on salary, provided that freedom of choice by the insured person among salaried and panel physicians be maintained.

In the earlier bill there was a provision for limiting the number of patients which any panel physician might have, to not over one thousand insured persons. The Young bill recognizes the desirability of making such limitations under certain circumstances, and gives power to the Commission, on the recommendation of the Medical Advisory Board, to lay down the maximum number of patients to be allowed a panel physician in any district; but no specified maximum is fixed.

The difficult question of the method of remuneration of panel physicians, on which various suggestions have been made by the Committee of the American Medical Association, the Committee of the Massachusetts Medical Society and others, is dealt with in the Young bill as follows: the funds or societies who carry insurance under the act are to make their arrange-

ments for medical and surgical attendance and treatment with the physicians or associations of physicians, subject always to the approval of the State Commission, which can take action only after the matter has been submitted to the Medical Advisory Board. It is also provided that the payment of panel physicians shall be upon a visitation basis. This, if passed by the Legislature in such form, would eliminate the *per capita* system. No private insurance company may do business under the act, the "funds" being local mutual associations, in the government of which employers and employees have an equal voice.

The State Commission, which is the supreme administrative authority for the health insurance system, is, according to the Young bill, to be of five members, and it is specified that "one shall be a wage-earner, one an employer, and one a physician." The Medical Advisory Board is to consist of eleven members, including the State Commissioner of Health, *ex officio*; the Secretary of the State Board of Registration in Medicine, *ex officio*; and nine physicians, of whom seven are to be chosen by the Massachusetts Medical Society, and two by the Homeopathic Medical Society, their terms to be so adjusted that a certain number go out of office each year. The powers of the State Medical Advisory Board are very important, and the Young bill has enlarged them. All regulations of the Commission relating to physicians and to medical benefits must be referred to the Medical Advisory Board before action by the Commission. Standards for the hospitals and dispensaries, which must provide service under the act, for admission to practise under the act as specialists, for obstetrical care, etc., are to be outlined by the Medical Advisory Board and recommended to the Commission. Power is given to the Commission, after the Medical Advisory Board has passed on the evidence, to discipline a physician, by suspension or removal from practice under the act, this provision following closely the recommendation of the Committee of the Massachusetts Medical Society.

An extremely important feature is the local medical committee which, under the Young bill, is elected by the panel physicians, with representation from the staff of local medical institutions and from the local department of health. This local committee is given a veto power, as well as advisory powers, on medical regulations and questions with which the local funds are

concerned; and the working of such local medical committees should be an essential factor in adjusting suitably the relations of the medical profession to the health insurance system. Provision is made in the Young bill for medical officers who are to pass upon the certificates of disability to work, entitling the insured person to cash benefits, much as outlined in a JOURNAL editorial, January 11 (p. 68). Provision for preventive medicine is made in the Young bill to a greater extent than in any preceding proposal we have seen. The health departments are represented on the governing medical bodies of the State and of each locality. The medical officers, just referred to, may, when directed by the local committees, and under proper supervision by the appropriate public health authorities, carry on preventive or educational work; and the local funds are specifically permitted to be appropriated for preventive measures, the purposes for which these funds shall be expended being subject to the approval of the local or State public health authorities. It is gratifying that so much more detailed consideration has been given, in the Young bill, to the relationship of the medical profession to the proposed health insurance, than was apparent in the bill of last year.

CHICAGO CONFERENCE ON MEDICAL EDUCATION.

THE annual mid-winter conference on medical education, public health and medical licensure will be held in Chicago on Monday and Tuesday of next week, February 5 and 6, under the auspices of the council on medical education and the council on health and public instruction of the American Medical Association, the Federation of State Medical Boards of the United States, and the Association of American Medical Colleges. The morning session on February 5 will be devoted to the subject of medical education, with an address on the problem of higher degrees in medicine, by Dr. Horace D. Arnold of Boston, and a symposium on economy of time in preliminary and medical education. The afternoon session on this day will be devoted to medical licensure, with an opening address by Dr. Walter P. Bowers, secretary of the Massachusetts Board of Registration in Medicine, on practical examinations by state licensing boards.

The conference on this day will be opened by Dr. Arthur D. Bevan, and on February 6 by Dr. Frank Billings of Chicago. The morning session of February 6 will be devoted to the subject of public health instruction in medical colleges, with a closing paper by Dr. Milton J. Rosenau of Boston on the training of the public health officer in medical colleges. The afternoon session of this day will consider the subject of state regulation of medical practice. The executive and business sessions of the Federation of State Medical Boards of the United States and of the Association of American Medical Colleges will be held during the forenoon of February 6. A cordial invitation is extended to all members of state medical societies to attend and take part in this important conference.

THE ELIMINATION OF THE RAT.

IN another column of this issue of the JOURNAL is quoted an article by Dr. Edwin H. Brigham, describing the epidemic of bubonic plague which visited Boston in 1798. In this article Dr. Brigham emphasizes also the importance and desirability of the complete elimination of the rat from civilized communities, a work which has been energetically undertaken in Boston by the Women's Municipal League. In this connection, attention should be directed to a monograph about the destruction of the rat, which has been written especially for the League by Dr. Richard H. Creel, assistant surgeon-general of the United States Public Health Service. This monograph, just published by the League, describes the species and prevalence of rats in the United States, their habits, their destructiveness, their danger as disease-transmitters, and the methods of rat destruction and rat proofing. Copies of this monograph may be obtained from the League headquarters at 6 Marlborough Street. The interest of physicians and other readers of the JOURNAL is directed to this important campaign, for which also funds are earnestly solicited by the League.

MEDICAL NOTES.

INTERSTATE MEDICAL JOURNAL.—It is announced that with its issue of January, 1917, the *Interstate Medical Journal*, which has been purchased by the organization controlling the

Modern Hospital, will enter a new era of service to the medical profession. In making this announcement, the *Interstate Journal* asserts a critical policy towards industrial health insurance and other forms of social legislation, which threatened the rights and liberties of the medical profession, and states that it purposes to address itself to the problems involved in such legislation and assist the American profession in the development of a sound, constructive policy with regard to them.

EUROPEAN WAR NOTES.

DEPARTURE OF AMERICAN SURGEONS FOR EUROPE.—On January 20 the following American surgeons sailed from New York City for England aboard the American line steamship *New York* for service in British hospitals and in France: Drs. James V. Ricci of the Rhode Island Hospital, Providence; Jerome F. Potts, Washington, D. C.; William M. Findley, Bellevue Hospital, New York; Frederick A. Simonds, Wakefield; J. Frederick Harvey, Boston; Charles Curtis Allen, Topeka, Kan.; Leo Thomas Kewer, Waverley; Carl Edwin Allison, Wakefield; Charles F. Gormly, Providence; William H. Mackay, Worcester City Hospital, Worcester, and Audley Sanders, Boston.

WOMEN MEDICAL PHYSICIANS IN ITALY.—It is announced that, owing to the shortage of male physicians in Italy, the Italian minister of war has recently called upon Italian women physicians to volunteer for military service. Graduates of over five years' standing will receive the rank of sub-lieutenant, those of between five and fifteen years will receive rank of lieutenant and those of over fifteen years that of captain. Dr. Filomena Corvini has been appointed medical director of the Ninth Italian Army Corps for service at the front.

WAR RELIEF FUNDS.—On Jan. 26 the totals of the principal New England relief funds for the European War reached the following amounts:

French Wounded Fund	\$187,004.77
French Orphanage Fund	77,152.87
British Imperial Fund	74,152.49
Permanent Blind Fund	67,434.19
Surgical Dressings Fund	60,455.12
La Fayette Fund	21,627.03
Star and Garter Fund	507.50

BOSTON AND NEW ENGLAND

PHYSICIANS' CLUB OF WORCESTER.—The Physicians' Club of Worcester was organized on January 4, 1917, at 74 Providence street, Worcester, Mass., and the following officers were elected: President, C. F. Desmond, M.D.; secretary-treasurer, Max Baff, M.D. Members of the board of trustees are G. A. Tripp, M.D., S. A. Bergin, M.D., and J. J. Cummings, M.D. The judiciary committee is composed of J. J. Brennan, M.D.; W. J. Delahanty, M.D.; L. A. Cottle, M.D., and A. H. Lancaster, M.D.

Obituary.

EDWARD MARSHALL BUCKINGHAM, M.D.

DR. EDWARD MARSHALL BUCKINGHAM died Saturday, Dec. 23, 1916, after a very brief illness, of angina pectoris. He was born in Boston, August 9, 1848, the son of Dr. Charles Edward and Mary Elisabeth Marshall Buckingham. His grandfather was Joseph T. Buckingham of Cambridge, editor of the *Boston Courier* and the *New England Magazine*.

Dr. Buckingham was connected for a time with the class of 1870 of the Institute of Technology, but early transferred his studies to the Harvard Medical School, where he was graduated in 1874. He served as house surgical pupil at the Massachusetts General Hospital, and then studied for a time in Vienna. On his return he became connected with the Boston Dispensary, that institution which has been the initial place of public service for so many Boston physicians. He was subsequently connected as physician with various charities, among them Saint Luke's Home for Convalescents, Gwinn Home for Children, Home for Little Wanderers, and was visiting physician to the Children's Hospital and the Boston City Hospital, and he was long the secretary of the staff of the last-mentioned institution.

His chief medical interest was in diseases of children. He was long an instructor in pediatrics in the Harvard Medical School, and he was for a term the vice-president of the American Pediatric Society and president of the New England Pediatric Society, and this interest formed the basis of many of his contributions to periodical literature. He served his professional brethren at various times as secretary of different organizations, and for twenty years held the responsible position of treasurer of the Massachusetts Medical Society.

In his practice he came very near the ideal family doctor, for he thought of his patient as an individual and in his social relations and not as an isolated case of disease.

Dr. Buckingham was a wise counsellor. No one ever went to him for advice who did not depart with a new view. He was a keen critic: often considered conservative but always receptive of new ideas which he usually received with some modification of his own. He was a most valuable man with whom to "talk things over."

His interest in the world was by no means confined to his profession, but he was a careful student of many social problems. To quote but one: he was deeply interested in transportation problems and studied them deeply. Mountain climbing was one of his earlier pursuits. For many years he spent his summers in the mountains and knew the paths of the Presidential Range and their pioneers and explorers.

He was married on December 14, 1876, to Alice Nason, who survives him. He also leaves two daughters, Miss Edith N., and Mrs. Addison Gulick.

Memorial Resolutions.

MEMORIAL RESOLUTIONS FOR DR. KEANY.

WHEREAS, Francis Joseph Keany, M.D., born in Boston in 1866, educated in the public schools, Boston College and the Harvard Medical School, has recently passed away in the full vigor of life, and

WHEREAS, For nearly twenty years he was an active member of the Board of Trustees of the City Hospital and for some time at the head of the dermatological department, in both of which positions he rendered efficient service, faithful in his professional, as in his administrative duties, and

WHEREAS, During this long period his relations with the staff were harmonious and pleasant. His genial personality and his kindly disposition won him many friends. His freedom from bigotry, his broad, sensible views of the numerous problems constantly arising in an institution of this sort, and his wise conclusions were most commendable. His interest in the work of the staff never flagged. He was ready at all times to confer with them upon all matters pertaining to the welfare of the hospital and its inmates. Being the only physician upon the board of trustees, the staff naturally submitted strictly professional questions to him, feeling that they would receive careful attention. The relations of the staff to the trustees were greatly favored by his wise management of mutual interests. Now, therefore, be it

RESOLVED, That the members of the staff of the Boston City Hospital hereby place upon record their appreciation of the many fine qualities of Dr. Keany, of his long and faithful service to the hospital, of his unflinching loyalty to the patients, the staff and the community, which he served assiduously during his entire professional life.

GEORGE W. GAY, M.D., *Committee*.

Boston, January 1, 1917.

Miscellany.

BUBONIC PLAGUE IN BOSTON.

In the issue of the *JOURNAL* for October 19, 1916, (Vol. CLXXV, p. 576) we commented editorially on the movement initiated at that time by the Women's Municipal League of Boston for the extensive destruction of rats in this city. The immediate purpose of the movement at that time was not merely hygienic and economic, but had relation particularly to the possible importance of the rat flea in the transmission of poliomyelitis. Whether or no the destruction of rats is of real value in this respect, their eradication would be from every other aspect desirable. They are, of course, the chief spreaders of bubonic plague; and although risk of such an epidemic in Boston is slight, it is never-

theless a possibility. Dr. Edwin H. Brigham, in an article in the *Boston Advertiser* on December 28, 1916, has described as follows the history of a previous epidemic of bubonic plague in this city.

"The statement is made that Boston has never had bubonic plague and therefore is never likely to have it, which is a serious mistake. Aside from the absurdity of thinking that such an epidemic can never occur because there has been none in the past, the fact is that Boston did have bubonic plague, and badly, too.

"The great epidemic of 1798 that spread over Pennsylvania and followed the coast line through New England was called 'yellow fever,' but it had most of the symptoms of bubonic plague. It is to be remembered that at that period, diagnosis was not a well established art, and of course nothing was known of the true cause of disease. Because some corpses turned yellow from disturbances of the liver, it was given this name. Modern knowledge finds otherwise. In descriptions of cases written at the time, we read of the dreadful headaches, pains in back, limbs and loins, restlessness, mental depression, rapid breathing, bleeding from nose and mouth, burning thirst, high temperature, rapid pulse; all these followed by collapse and, in such patients as lived beyond the fifth day sometimes carbuncles and buboes were noticed.

"The outbreak of the disease in all places occurred about the different waterfronts and along the wharves, whence it spread through the cities into the surrounding country. Even at that time it was recognized that the disease was brought by shipping, and many vessels were quarantined, although, of course, no suspicion of the time rested upon the rats that infested the ships of the adjacent wharves and houses. This frightful epidemic practically depopulated Philadelphia with over 70 deaths a day, and the federal capital was removed to Trenton, while the Custom House, which was particularly infested, was abandoned, and the custom officers removed first to the Senate Chamber, and then to Chester. In New York City 40 died a day and so frightened were the inhabitants that the clergy even left their churches and fled into the country. New London suffered heavily and some 300 deaths occurred in Boston, the numerous cases keeping Dr. Warren and his colleagues working day and night.

"So little was known of the treatment for the disease that it was generally fatal, though all endeavors were used. Gen. Washington even sending to Germany for a medicine presumed to be efficacious. The first appearance of the disease in Boston was on July 21, 1798, near the market place, described as 'a low sunken part of the town, the reservoir of every putrid matter, surrounded with docks of stagnant water, filled with offal, and the market house and stalls always well supplied in abundance

with meats, some putrid'—an ideal feeding place for immigrant rats!

"The second case appeared at Codman's wharf, and 'for two or three weeks,' the story goes, 'all cases of the fever were of persons either stationed in or near the market or who often frequented this place.' The epidemic continued until the coming of frost, when it ceased.

"History is said to repeat itself, but I sincerely hope that a true knowledge of the origin and spread of plague in and through rats, will arouse the citizens of Boston to take such measures as to prevent this city from ever suffering such another horrible epidemic."

DECLINE OF POPULATION IN FRANCE.

IN a recent issue of the *Revue Scientifique*, Dr. Chambrelent presents a study of still-births in France with reference to the declining population of that country. The ratio of still- to quick-births in the whole of France is 4%. This ratio varies in different parts of the country according to local conditions of environment. In the whole of France the mortality rate per thousand living births is 47; in Paris, 93; in other cities over one hundred thousand inhabitants, 69; in smaller cities, 61; and in towns and cities of less than 30,000 inhabitants, 53. There is considerable difference in the infant mortality of different departments.

"The two central departments of France have the lowest rates, Creuse 25 and Indre 29, and the Bayonne mountainous country in the extreme southwest has the last-named figure. A ring about the central departments has the next lowest figures; the major portion of the country lies within the third group (40 to 50), the next higher group is almost altogether along the mountainous Swiss and German frontiers and the central ranges in Rhone and Ardèche, while the maximum figures are the Seine, Belfort in the Juras and in the southeast, four of the five departments east of the mouth of the Rhone. This is a geographical distribution that seems of interest, the effect of which is not as yet studied. The central, and in general they are rural districts, have the lowest mortality; the mountainous regions within the country, the Cevennes and Auvergnies, are higher; while the eastern mountainous borders have a figure even higher than the department that includes Greater Paris. The Pyrenees border makes a better showing than along the Alps.

"For purposes of comparison Dr. Chambrelent introduces the statistics of births according to sex. Males predominate in the ratio of 105 to every 100 females. The geographical distribution of the different figures does not follow such easily determined lines as before, the localities with similar conditions in vital statistics being irregularly scattered over the coun-

try. There is almost an equality of the sexes in Ardèche and a ratio of 108 to 100 in Upper Marne. There are occasional years in individual departments when there are more girls born than boys, but the averages, either of years or of the country, give the male babies somewhat the advantage. On the other hand, the ratio of still-born males to females is very high, running from about 120 to almost 170, the last figure being that of Corsica.

"The demands of the war are very largely for men, and the enormous losses of males in the engagements requires some consideration of conditions in the future. Dr. Chambrelent, therefore, analyzes in medical fashion the conditions surrounding the loss of those born dead or surviving but a short time. His observations, aided by the records of the Baudelocque clinic of about four thousand cases, point to the fact that there may be means of saving a large ratio of those now lost. This, he believes, may be accomplished by prenatal care, by more efficient service at the bedside and a better understanding of conditions, such as the age of the mother, the risk increasing rapidly after the age of twenty-five."

THE YOUNG INDUSTRIAL HEALTH INSURANCE BILL.

AN ACT

To establish a system of compulsory insurance to furnish benefits for employees in case of death, sickness and accident, not covered by workmen's compensation, and for their dependents in case of sickness and accident, and to furnish maternity benefits, and to provide for contributions by employers, employees and the state, and to create the Health Insurance Commission.

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

PART I.

SECTION 1. Definitions and Persons Insured. Recognizing that it is necessary to provide proper care for employees during sickness and pecuniary support for themselves and their families during period of inability to work on account of sickness, in order to prevent the spread of disease and to protect the health of the citizens of the commonwealth, and recognizing that modern industrial and social conditions have a part in causing sickness among wage-earners, the general court judges compulsory insurance against sickness to be for the good and welfare of this commonwealth and of the citizens of the same.

SECTION 2. Definitions. When used in this act:—

"Commission" means the health insurance commission.

"Fund" means a local or trade fund as the case may be.

"Society" means an approved society; viz: a labor union, a benevolent or fraternal society, or an establishment society, authorized to carry insurance under this act.

"Hospital" includes sanatorium unless otherwise provided.

"Insurance" means health insurance under this act.

"Disability" means inability to pursue the usual gainful occupation.

"Employer" means a person, partnership, association, corporation, the legal representative of a deceased employer, or the receiver or trustee of a person, partnership, association or corporation and the state, or a municipal corporation or other political division thereof.

"Home-workers" are persons to whom articles or materials are given out to be made up, cleaned, altered, ornamented, finished or repaired, or adapted for sale, in the worker's own home, or on premises not under the control or management of the employer.

"Earnings" shall include actual expenditures for or reasonable value of board, rent, housing and similar advantages given employees by the employer.

SECTION 3. Compulsory Insurance. Every person employed in the commonwealth, except those receiving regular salaries in excess of one hundred dollars a month, unless exempted under section five of this act, shall be insured in a fund or society as provided in this act.

SECTION 4. Bailment. For the purposes of this act, any person operating a vehicle or vessel for hire, the use of which is obtained under a contract of bailment, in consideration of the payment of a fixed sum or share in the earnings or otherwise, shall be treated as an employed person and the owner of the vehicle or vessel as an employer.

SECTION 5. Persons Exempt. The following persons shall be exempt from the provisions of this act:

Employees of the United States;

Employees of the commonwealth or of municipalities for whom adequate provision in time of sickness is already made through legally authorized means;

Inmates of charitable or reformatory institutions when employed for the purposes of the institutions, with or without maintenance, if provision for maintenance and medical attendance during sickness is made;

Casual employees not employed for the purpose of the employer's trade or business;

Members of the family of the employee who are not paid money wages.

SECTION 6. Persons Who May be Exempted. The commission may exempt:—

Home-workers, who, owing to the irregularity of their work or other circumstances connected with their work, cannot for administrative reasons be included in the system of the insurance;

Persons employed for periods of not over one week at temporary employment;

Members of religious societies employed in nursing, educational or other activities of public benefit, who receive no money compensation.

SECTION 7. Voluntary Insurance. Subject to the conditions of this act, the following persons may insure themselves voluntarily:—

Self-employed persons whose earnings do not exceed one hundred dollars a month on an average.

Persons formerly compulsorily insured who, within one year from date on which they cease to be insured, apply for voluntary insurance.

Members of the family of the employer who work in his establishment without wages.

PART II.

BENEFITS.

SECTION 1. Cases in Which Benefits Paid. Benefits as provided in this act shall be paid or furnished in cases of sickness or accident, or of death or disability resulting therefrom, except cases in which any liability or compensation or other benefit is imposed by the workmen's compensation law, or in which liability for damages, compensation or other benefits is imposed by any act of congress.

SECTION 2. Reimbursement of Fund. If benefits in

the form of cash are paid to any person by any fund or society under this act in any case under which liability for compensation exists under the workmen's compensation law, such fund or society shall to the extent of such benefits be entitled to reimbursement out of such compensation, and upon notice to the carrier under the workmen's compensation law the claim for reimbursement shall be a lien upon the compensation. If other benefits are furnished by the fund or society in such case it shall, to the extent of the actual expenses incurred in furnishing such benefits, be subrogated to the right of the employee or of the person furnishing such benefits to reimbursement therefor under the workmen's compensation law. When treatment in such case has been begun by or through a fund or society the care of the case shall not be transferred to the carrier under the workmen's compensation law except upon the request of such carrier.

SECTION 3. Minimum Benefits. Every fund or society must provide for its insured members as minimum benefits:—

Medical, surgical, dental and nursing attendance and treatment.

Medicines and medical and surgical supplies.

Sickness benefit to the insured person or the dependent members of his family.

Maternity benefit.

Funeral benefit.

Medical, surgical and nursing attendance, and medicines, and medical and surgical supplies, for dependent members of their families.

SECTION 4. Beginning of Right. The right to benefits, with the exception of maternity benefits, begins with the day of membership. The maternity benefit shall be payable to any woman insured against sickness for at least nine months during the twelve months preceding the confinement, to the wife of any man so insured, and, as respects confinement for a child of her husband, to the widow of any man insured for at least nine months during the twelve months preceding his death.

SECTION 5. Medical, Surgical, Dental and Nursing Attendance and Treatment. All necessary medical, surgical and nursing attendance and treatment shall be furnished by the fund or society to insured persons and the dependent members of their families, from the first day of sickness or the happening of an accident, provided notice has been given; otherwise from the date of such notice. In case of disability such attendance and treatment shall not be furnished to the same person for more than twenty-six weeks of disability in any consecutive twelve months. All urgently necessary dental services shall be furnished to insured persons, by the fund or society. In case the fund or society is unable to furnish the whole or any part of the benefit provided in this section, it shall pay the cost of such service actually rendered by competent persons at a rate approved by the commission.

SECTION 6. Medical and Surgical Service. The fund or society, subject to the approval of the commission, and to the provisions of part five, section seventeen, of this act, shall make arrangements for medical and surgical attendance and treatment by means of either:

1. A panel of physicians to which all legally qualified physicians, surgeons, hospitals, dispensaries and associations of legally qualified physicians and surgeons shall have the right to belong, and from among whom the patients shall have free choice, subject to the right of the physician and surgeon to refuse patients on grounds specified in regulations made under this act; provided that the commission, on the recommendation of the medical advisory board, may limit in the interests of the medical service the maximum number of patients to be allowed a panel physician. Such maximum may vary in different districts. The payment of panel physicians shall be upon a visitation basis.

2. On request of a fund or society, the commission, with the approval of the medical advisory board, may permit in combination with the panel system the employment of legally qualified physicians on salary, provided that freedom of choice by the insured persons among salaried and panel physicians be maintained.

SECTION 7. Nursing Services. The fund or society, subject to the approval of the commission, shall make arrangements with nurses, dispensaries, hospitals or nursing organizations, for nursing attendance and treatment.

SECTION 8. Laboratory Facilities and Specialists. The fund or society shall provide proper laboratory and other facilities for diagnosis and treatment, and shall make arrangements with specialists, including dentists, for consultations, treatments and operations.

SECTION 9. Medical and Surgical Supplies. Insured persons and the dependent members of their families shall be supplied with all necessary medicines, medical and surgical supplies, dressings, eyeglasses, trusses, crutches and similar appliances prescribed by the physician or surgeon. The supplies under this section shall not in any one year exceed fifty dollars for an insured person and the dependent members of his family.

SECTION 10. Hospital Treatment. Hospital or sanatorium treatment and maintenance shall be furnished, upon the approval of the medical officer of the fund or society, instead of all other benefits (except as provided in Part II, sections 18, 23 and 28), with the consent of the insured member, or that of his family when it is not practicable to obtain his consent. The fund or society may demand that such treatment be accepted when required by the contagious nature of the disease, or when in the opinion of its medical officer such treatment is imperative for the proper treatment of the disease or for the proper control of the patient. Sickness benefit may be discontinued (except as provided in Part II, section 18) during refusal to submit to hospital or sanatorium treatment. Such treatment shall be furnished during the period for which sickness benefit is payable, and shall be provided in a hospital or sanatorium with which the fund or society has made satisfactory financial arrangements approved by the commission, or in one erected and maintained by the funds and societies with the approval of the commission.

SECTION 11. Medical Officers. Each fund or society shall employ at least one medical officer, who shall be a legally qualified physician and possess such other qualifications as the medical advisory board may prescribe. The appointment of a medical officer shall be subject to the approval of the local medical committee, but in case of failure or refusal to approve, appeal may be taken to the medical advisory board, whose decision shall be final. No medical officer shall practice in any other capacity under this act.

SECTION 12. Duties of Medical Officers. A medical officer shall make such inspections and reports as the local medical committee shall direct, which reports, if of violation of sanitary laws, ordinances, or regulations, and all other reports required by the health authorities, shall be forwarded by the health officer upon such committee to the proper health authority; and, upon charges of failure or neglect to make such inspections or reports a medical officer may be removed by the arbitration committee after a hearing. The decision of the arbitration committee shall be final.

SECTION 13. Local Medical Committee. There shall be in each district formed in accordance with Part IV, Section one, and in which there is a panel, a local medical committee of not less than seven or more than fifteen members. The commissioner of health in each city in which there is a commissioner of health, or local health officer elsewhere, shall serve or shall appoint a member of his staff, who shall be a physician, as a member of the local medical com-

mittee of each district within his jurisdiction. The other members shall be legally qualified physicians and shall be elected for terms of three years, part by the physicians on the panel of the funds in the district, part by the staffs of attending physicians and surgeons of the hospitals which have made agreements with funds in the district, to treat insured persons. The commission, subject to the approval of the medical advisory board, shall determine the proportion of members of the local medical committee to be elected by the panel physicians and by the attending physicians and surgeons of said hospitals. The committee shall elect its own officers and shall serve without compensation.

SECTION 14. Meetings of the Committee. The committee shall meet at least once every month and may be called together at any time on three days' notice by the chairman or by a call signed by five members. A majority of the members of the committee shall constitute a quorum.

SECTION 15. Powers and Duties of the Committee. All regulations and contracts affecting medical, surgical, nursing or dental attendance and treatment made by the board of directors of a fund or society shall be submitted to the local medical committee of its district, and shall not take effect until after the next regular meeting of the committee unless sooner acted upon by the committee, except that the board may issue temporary regulations for the period of three months. Any dispute in regard to such attendance or treatment, or any charge brought against a physician because of his work for a fund or society, shall be referred to the local medical committee of the district before action is taken by the board of directors. If the committee and the board of directors cannot agree, the matter shall be referred to the arbitration committee.

SECTION 16. Arbitration Committee. Any dispute between a fund or society and a physician, or any dispute submitted as provided in Part II, section 15, shall be referred to an arbitration committee, one member appointed by the board of directors of the fund, one member appointed by the local medical committee and a third member, who shall be a chairman, appointed by a judge of the superior court or by a justice of the supreme court in counties in which there is no county court. The decision of the arbitration committee shall be final unless an appeal is taken to the commission within ten days from the date on which the decision is rendered.

SECTION 17. Sickness Benefit. A sickness benefit, equal to two-thirds (66 2/3 per cent.) of the weekly earnings of the insured member, shall be paid beginning with the fourth day of the disability on account of illness or accident. It shall be paid only during continuance of disability, and shall not be paid to the same person for a period of over twenty-six weeks in any consecutive twelve months. This benefit shall be paid to an insured woman when disabled on account of pregnancy, except that it shall not be paid to her during the period when she is receiving cash maternity benefit. The weeks during which sickness benefit is discontinued because of refusal to accept hospital treatment shall be included in computing the period of twenty-six weeks.

SECTION 18. Sickness Benefit to Dependents. A sickness benefit equal to one-half (50 per cent.) of the earnings of the insured member shall be paid to his family, if any, or other dependents, if any, while he is in the hospital or sanatorium, or in any other institution, or while he refuses to submit to treatment.

SECTION 19. Certificate of Disability. A certificate of disability shall be issued only by a medical officer, and only after his personal examination of the patient and upon a statement by the attending physician, if any. Sickness benefits shall be paid only upon a certificate of disability. A medical officer may visit at any time persons recommended for or receiving sickness benefits.

SECTION 20. Computation of Benefits. For the purpose of computing the sickness benefits, weekly earnings shall be taken as the earnings during the last six days on which the employee worked full time preceding disability, not including earnings for overtime, unless such overtime is a regular occurrence in the employment; but if this computation would be unfair to the employee, his weekly earnings shall be taken as six times his average daily earnings for the days actually employed at full time during the three months preceding disability.

SECTION 21. Periods of Payment. Sickness benefits shall be paid weekly where possible, and in no case less frequently than semi-monthly.

SECTION 22. Maternity Benefit. Maternity benefit shall consist of: All necessary medical, surgical, nursing and obstetrical aid, materials and appliances, which shall be given insured women and the wives and widows of insured men.

A weekly maternity benefit, which shall be payable to insured women only, equal to the regular sickness benefit of the insured, for a period of eight weeks, of which at least six shall be subsequent to delivery, on condition that the beneficiary abstain from gainful employment during the period of payment.

Benefits under this section shall be in addition to all other benefits under this act.

SECTION 23. Funeral Benefits. The fund or society shall pay the actual expenses of the funeral and burial of a deceased insured member, as arranged for by the family or next of kin, or in absence of such by the officers of the fund or society, up to the amount of \$100. This benefit shall be paid in case of death of a former insured member within six months after discontinuance of sickness benefits because of the exhaustion of the time limit, provided he has not, within those six months, become insured in another fund or society.

SECTION 24. Assignments and Exemptions. Claims for benefits under this act shall not be assigned, released or commuted, and shall be exempt from all claims of creditors and from levy, execution and attachment or other remedy for recovery or collection of a debt, which exemption may not be waived. Benefits shall be paid only to the person or persons entitled to receive the same, or to some person who is liable by law or in fact for the support of such person or persons.

SECTION 25. Additional Benefits. A fund or society may grant the following additional or increased benefits if the commission be satisfied that its income is sufficient for the purpose.

(a) Extension of sickness benefit to exceed twenty-six weeks but not to exceed fifty-two weeks.

(b) Funeral benefits for members of the family.

(c) Increased amount allowed for medical and surgical supplies and appliances.

(d) Increase in the period of extended insurance.

(e) Dental work in addition to that provided under Part II, section 5, either up to a certain amount per year or by contribution of part of the cost.

SECTION 26. Extension of Insurance. When contributions cease on account of unemployment not due to sickness, right to benefit under this act shall continue in force for one week if the insured person has paid contributions during four weeks immediately preceding unemployment, and for an additional week for each additional four weeks of paid-up membership during the twenty-six weeks immediately preceding unemployment.

SECTION 30. Prevention of Disease. Funds or societies, may, with the consent of the commission and for purposes approved by the appropriate local or state public health authorities, make appropriations for prevention of disease and the education of its employer and employee members in disease prevention and hygiene, and include the amount so appropriated among its expenses of administration.

PART III.

CONTRIBUTIONS.

SECTION 1. *Apportionment of contributions.* The full cost of insurance provided by this act, including contributions to the reserve and to the guarantee fund, shall be borne by employers, employees and the commonwealth in the following proportions: employers, two fifths, employees, two fifths, and the commonwealth, one fifth, except as provided in section two.

SECTION 2. *Contributions of low paid workers.* If the earnings of insured persons are less than nine dollars a week the shares of the employer and employee of the amount paid by them jointly shall be in the proportion indicated in the following table:—

IF EARNINGS UNDER	BUT NOT UNDER	EMPLOYER	EMPLOYEES
\$9	\$8	60%	40%
8	7	70%	30%
7	6	80%	20%
6	5	90%	10%
5	—	100%	0

The contribution of the commonwealth shall remain one-fifth of the total.

SECTION 3. *Amount of Contributions.* The amount of the contributions shall be computed so as to be sufficient for the payment of benefits, the expense of administration of the funds and its reserve, and the maintenance of the guarantee fund.

SECTION 4. *Payment of Contributions.* Every employer shall, on the date on which he pays his employees, or at least monthly, pay to any local or trade fund the total contributions due from him and from his employees to such fund. If such contribution is made at such time, he may deduct from the earnings of any employee the share of that employee in the contribution, which shall be in proportion to his earnings, but must inform him, in a method to be approved by the commission, of the amount so deducted. Approved societies shall provide by regulation, to be approved by the commission, for the payment of contributions by their members. The employer of each such member shall be excused from contributing in respect to him to the local or trade fund, as above provided, only upon proof that such contributions to an approved society have been duly made in respect to such member and not otherwise.

SECTION 5. *Rates of Contributions.* In funds in which employees in several industries are insured, contributions may be fixed at different amounts for different industries according to the degree of sickness hazard in those industries, and shall be so fixed if the commission finds a substantial difference in the degree of sickness hazard.

SECTION 6. *Establishments With Excessive Rates of Sickness.* If the establishment of any employer shows an excessive rate of sickness, a fund may, subject to the approval of the commission, increase the rate of contribution of such employer in proportion to the excess of such rate of sickness above the normal rate. Such additional contributions shall be paid by the employer without the right of deducting from the earnings of his employees.

PART IV.

CARRIERS.

SECTION 1. *Division of the Commonwealth into Districts.* The commission shall within six months after this act goes into effect, divide the commonwealth into districts, no one of which shall contain less than five thousand persons subject to compulsory insurance.

SECTION 2. *Establishment of Funds.* The commission shall before April first, nineteen hundred and eighteen, hold one or more hearings in each district, notice of which shall be given by advertisement in at least one newspaper published in the district and by any other method approved by the commission, and shall thereafter establish one or more funds, and

in their discretion may establish one or more trade funds in such district. The commission shall then provide in each district for the election of delegates, half of whom shall be elected by employers, half by employees affected, to conventions for each fund, which shall have power to adopt constitutions. The expense of the elections and conventions shall be paid by the commonwealth as expenses of the commission are paid.

SECTION 3. *Consolidation of Division of District.* The commission at any time on its own motion or on the petition of the board of directors of any local or trade fund may consolidate two or more districts or detach a territory from one district and annex it to another, or create a new district from parts of several districts or from one district, already in existence, and shall make such disposition of the property of the dissolved fund as shall seem to it proper.

SECTION 4. *Establishment of Trade Fund.* On application of employers whose principal place of business or establishments are within the same district, and who employ two hundred and fifty employees in the same trade or branch of trade, or on the application of two hundred and fifty employees employed in the same trade by employers whose principal places of business or establishments are within the same district, the commission, after a hearing within the district, which shall be duly advertised and notice of which shall be sent to the boards of directors of the local and trade funds within the district, may authorize the formation of a trade fund, if there be no other trade fund within the district, for the trade or the branch of the trade, and if the establishment of the new fund will not impair the solvency of any local or trade fund in the district. The new fund shall receive a proportionate share, to be determined by the commission, of the reserve and other property of each fund to which any of its insured members belong at the time of becoming members of the new fund.

SECTION 5. *Temporary Establishment Society.* If a sufficient number of employees are employed temporarily, the commission, of its own motion, or on the application of the board of directors of any fund affected, may order the creation of an establishment society for the duration of the work. The commission shall divide any surplus left in such fund between the employers and employees in proportion to the amount of their contribution after having provided for all the obligations of the fund.

SECTION 6. *Authorization by Commission.* No fund shall begin business until it is authorized by the commission. The commission shall authorize a fund only after approval and filing of its constitution and after the names and addresses of the board of directors elected for the first year have been filed with the commission.

SECTION 7. *Dissolution of Fund.* The commission may, after a hearing in the district for which a fund is established, withdraw its approval and dissolve the fund.

If rendered necessary by the consolidation or dissolution of a district.

If the number of insured members is so small as to endanger the solvency of the fund.

Upon the petition of a majority of the board of directors or of the committee.

The assets and property of a dissolved fund, after provisions for benefits and for the payment of its obligations, shall be divided among the funds and societies which its former insured members join, in such proportions as the commission may determine.

SECTION 8. *Continuance of Existence of Dissolved Fund.* A dissolved fund shall, nevertheless, continue in existence for the purpose of paying any existing obligations, disposing of, collecting and distributing its assets, and doing all other acts required in order to adjust and wind up its business affairs, and may sue and be sued for any of the purposes of this section.

SECTION 9. Powers of Funds. Funds shall be corporations and shall have all the power necessary to carry out their duties under this act, including the power to verify by audit pay rolls of employer members for the purpose of determining contributions for which employer members are liable.

SECTION 10. Constitution of Fund. Subject to the provisions of this act, the constitution of a fund shall contain:—

Name of the fund and location of its principal office.

If the fund is a trade fund, designation of the trade or trades for which it is created.

Maximum percentages of earnings as provided in sections 30 and 31 of Part IV of this act, at which the regular contribution of employer and employee may be fixed; which maximum, inclusive of the contribution of the commonwealth, shall not exceed four per cent. of such total, except with the approval of the commission, and shall in no case exceed six per cent. of such total.

Nature and amount of benefits and length of time during which they shall be given.

Manner of election, number, power, duties and time of meeting of all committees.

Number, powers, duties and time of meeting of the board of directors.

Method of amendment of constitution, and such other provisions as may be directed by the commission.

SECTION 11. Committee of the Fund. There shall be a committee of each fund which shall consist of not less than twenty and not more than one hundred members, to be elected in the manner provided in the constitution, one half by the employer members of the fund, one half by the employee members. The committee shall cause an audit of the accounts of the fund to be made each year and shall pass upon the same and upon the annual report and budget of the board of directors.

SECTION 12. Employers' Votes. Each employer member shall have as many votes for employer members of the committee as he employs workmen subject to the insurance who are members of the fund, except that no one employer shall have more than forty per cent. of the total votes unless otherwise provided in the constitution.

SECTION 13. Board of Directors. The board of directors shall consist of an even number of directors, not less than eight and not more than eighteen, one half of whom shall be elected by employer members of the committee and one-half by employee members of the committee, and in addition one director who shall be chosen for a term of three years by a majority vote of the directors so elected. No one shall be a member of the committee and a director at the same time and all directors must be citizens of the United States, and a majority of both employer and employee directors must be residents of the commonwealth. The directors elected by the members of the committee shall be elected for three years, but the directors first elected shall by lot be divided into classes so that as nearly as possible an equal number shall go out of office each year. The compensation of the members of the board shall be not more than five dollars a day for each day of attendance upon the meetings of the board. No director shall hold any other office under this act.

SECTION 14. Removal of Directors. If a board of directors violate or fail to comply with this act, the commission may, after a public hearing, remove the directors, appoint temporary directors, and call a meeting of the committee to elect directors to fill the unexpired terms of the directors removed. The directors appointed by the commission shall serve until the directors thereafter elected by the committee qualify.

SECTION 15. Appointment of Directors by Commission. If at any time the number of directors be not sufficient to carry on the affairs of the fund, and if

after notice from the commission, the committee fail to elect directors, the commission may appoint directors who shall serve until those thereafter elected by the committee qualify.

SECTION 16. Powers of the Board. The board shall—

Fill vacancies in its own number for unexpired terms; *provided*, that only employers' representatives shall vote for employer directors, and only employees' representatives for employee directors.

Appoint all officers and employees of the fund and fix their salaries.

Elect a president and secretary from their own number.

Make regulations necessary for carrying out the purposes of the fund.

Make contracts with physicians, nurses, hospitals, dispensaries, pharmacists, institutions and associations, and any other persons necessary for the business of the fund.

Prepare and submit to the committee annually a financial account and a report for the past year and a budget for the ensuing year.

Represent the fund and direct and administer its affairs, except as otherwise specified in this act.

SECTION 17. Officers' Bonds. All officers of a fund who are intrusted with its moneys shall be bonded for amounts to be determined by the board of directors with the approval of the commission.

SECTION 18. Reserve. Every fund shall accumulate a reserve. The board of directors shall transfer to such reserve one twentieth of the annual income of the fund until such reserve is equal to one sixth of the total expenditures for the preceding three years.

SECTION 19. Membership in Fund. Every person subject to insurance shall, by virtue of this act and without regard to his physical condition, be an insured member of the trade fund of the trade at which and in the district in which he is employed, or if there be no such fund, of such local fund of the district, as provided by the regulations of the commissions, provided that while he is a member of an approved society he shall be excluded by the board of directors from membership in a fund. The commission shall provide by regulation for the case of persons regularly occupied at one trade but temporarily employed at another. Membership in a local or trade fund shall cease as soon as the insured person becomes a member of another local or trade fund. Every employer shall by virtue of this act be an employer of all funds of which any of his employees are members.

SECTION 20. Membership in Societies. A person subject to insurance shall become a member of an establishment society on the day of entering employment in the establishment, and shall, except as otherwise provided by law or in the constitution or by-laws, cease to be such member on quitting employment in the establishment.

Of a labor union or a benevolent or fraternal society on being accepted by it, and shall cease to be such member on his resignation or expulsion, except as otherwise provided by law or in the constitution or by-laws.

SECTION 21. Membership During Disability. Insured membership shall continue during receipt of sickness or cash maternity benefits or hospital treatment or during discontinuance of sickness benefit, because of refusal to accept hospital treatment, except that no such insured member shall have a vote or be included in the number of insured members on which the vote of any employer member is based.

SECTION 22. Residents Without the District. If an insured person reside in the commonwealth, but temporarily or permanently outside of the district of the fund of which he is a member, the trade fund of the same trade, or if there be none the local fund in the district in which he resides, shall supply the minimum benefits provided in this act and shall be retri-

bursed by the fund of which the insured person is a member. Other benefits shall be paid in cash if not provided for by agreements between funds or otherwise. The commission shall provide by regulation for insured persons residing permanently or temporarily without the commonwealth.

SECTION 23. Determination of District of Employment. The district in which the establishment in which an insured person is employed, or if he be not employed in an establishment, the district in which the principal place of business of the employer is located, shall be, for the purpose of this act, the district of employment, but the commission may, for the convenience of administration either permanently or temporarily establish as such district that in which the insured member is actually employed or in which his wages are paid.

SECTION 24. Voluntary Insurance. A person entitled to voluntary insurance must be admitted on application to membership in the trade fund of his trade in the district in which he is employed, or if there be no such fund, then in such local fund of the district as is provided by the regulations of the commission; *provided*, that, except for persons who have been compulsorily insured persons within one month, the by-laws, of any fund may prohibit the admission to voluntary insurance of a person who has not passed a satisfactory medical examination by its medical officers. The contribution and benefits shall—

(1) Be based upon such an amount of earnings, in the case of a person formerly compulsorily insured, not exceeding the earnings upon which his contributions and benefits were based immediately preceding the date upon which he ceased to be so insured, and in the case of other voluntary members upon not more than actual earnings, nor more than one hundred dollars per month, as the member may elect.

(2) Be the same as for a compulsory member of the same trade. The full contribution in the case of a voluntary member shall be borne by the member and the state in the following proportion; the member four-fifths and the state, one-fifth.

SECTION 25. Loss of Voluntary Membership. A person voluntarily insured shall lose his membership if he acquires membership, either voluntary or compulsory, in another fund or society, or if he be in arrears for one month in the payment of his contributions, unless this period be extended by the fund or society.

SECTION 26. Fines and Penalties. Funds and societies may fine their employer and insured members and suspend insured members from benefits for violation of their rules or regulations or for fraudulent representations made with the intent of securing or aiding another to secure benefits, in accordance with rules approved by the commission providing for and limiting such fines or suspension, but contributions will in every case be required in respect of each suspended member. If an employer fail or refuses to pay any contribution due to a fund under this act, the fund to which the contribution is due may recover from such employer the whole amount of such contribution due from such employer, and his employees, with interest at six per cent, by suit in a court of competent jurisdiction, and the employer shall not be entitled to deduct any part of such sum from the earnings of his employee or employees.

SECTION 27. Approved Societies. A labor union, a benevolent or fraternal society or an establishment society shall be approved by the commission only after hearing the local or trade funds affected and only if:

It is not carried on for profit; but reasonable salaries paid officials shall not be considered profit.

It is under the absolute control of the insured members in so far as the insurance regulated by this law is affected, except that the employer may appoint one half of the governing body of an establishment society.

It shall satisfy the commission it is in a sound financial condition.

It grants at least the minimum benefits provided in this act.

It has a membership of at least five hundred persons insured for at least the minimum benefits provided under this act or their equivalent, except that in the case of establishment societies in which the employer satisfactorily guarantees the payment of benefits, the minimum number of members may be determined by the commission.

Its operation will not, in the opinion of the commission, endanger the existence of any local or trade fund.

In case of an establishment society, a majority of the employees subject to insurance request approval, and the employer's contribution be at least equal to that of all the employees.

The approval of the commission may be withdrawn at any time upon its finding, after hearing the society affected, that any of the required conditions are no longer satisfied. The commission may, after a hearing, permit an establishment society to accept as members on conditions satisfactory to the commission, all persons subject to insurance in its district.

SECTION 28. Employers' Contributions. The commission shall assess upon every employer any of whose employees are insured in an approved society other than an establishment society, a sum equivalent to the employer's contributions had such employees been members of funds. This sum shall be paid in monthly installments into the guarantee fund established by the commission.

SECTION 29. Contributions of the Commonwealth. The commonwealth shall contribute to every approved society, one fifth of its total expense for health insurance under this act, subject to the provisions of Section nine, of Part V of this act.

SECTION 30. Wage Groups. A fund or society may, with the approval of the commission, divide its members into wage classes, and fix the rates of sickness and maternity benefits and the rate of contributions in each class.

SECTION 31. Basis of Contribution and Benefits. A fund or society may, for the purpose of calculating benefits and contributions under this act, estimate the average earnings in any employment or grade or branch thereof, and on the approval of the commission the average so determined shall form the basis for the calculation of such benefits and contributions.

SECTION 32. Property of the Fund Tax Free. The property of a fund, and such part of the property of any approved society as is used for the purposes of this act, shall be exempt from all commonwealth, municipal or local taxes.

SECTION 33. Contributions a Preferred Claim. Contributions due and unpaid shall have the same preference or lien, without limit of amount, against the assets of the employer as is now or hereafter may be allowed by law for a claim for unpaid wages for labor.

SECTION 34. Health Insurance Union. Two or more funds or societies may combine for the administration of the medical benefit, subject to the approval of the commission. The commission may, after notice to and hearing of the parties in interest, withdraw its approval and dissolve the union, making such disposition of its property as may seem to it in the best interests of the insured.

PART V. COMMISSION.

SECTION 1. Health Insurance Commission. The health insurance commission is hereby created, consisting of five commissioners, to be appointed by the governor, one of whom shall be designated by the governor as chairman. Of the five members, one shall be a wage-earner, one an employer, and one a physician. The term of office of members of the commission shall be five years, except that the first members thereof shall be appointed for such terms that

the term of one member shall expire on January first, nineteen hundred and nineteen, and one on January first of each of the four succeeding years. Each commissioner shall devote his entire time to the duties of his office, and shall not hold any position of trust or profit, or engage in any occupation or business interfering with or inconsistent with his duties as commissioner, or serve on or under any committee of a political party. The commission shall have an official seal which shall be judicially noticed.

SECTION 2. Secretary. The commission shall appoint and may remove a secretary, at an annual salary of three thousand six hundred dollars. The secretary shall perform such duties in connection with the meetings of the commission, and its investigations, hearings, and the preparation of rules and regulations under the provisions of this act, as the commission may prescribe.

SECTION 3. Officers and Employees. The commission may appoint such officers, other assistants and employees as may be necessary for the exercise of its powers and the performance of its duties under the provisions of this act, all of whom shall be in the competitive class of the classified civil service; and the commission shall prescribe their duties and fix their salaries, which shall not exceed in the aggregate the amount annually appropriated by the legislature for that purpose.

SECTION 4. Salaries and Expenses. The chairman of the commission shall receive an annual salary of four thousand, five hundred dollars, and each other commissioner an annual salary of four thousand dollars.

The commissioners and their subordinates shall be entitled to their actual and necessary expenses while travelling on the business of the commission. The salaries and compensation of the subordinates and all other expenses of the commission shall be paid out of the treasury of the commonwealth upon vouchers signed by the chairman or one of the commissioners designated by him for that purpose.

SECTION 5. Offices. The commission shall have its main offices in the City of Boston and may establish and maintain branch offices in other cities of the commonwealth as it may deem advisable. Branch offices shall, subject to the supervision and direction of the commission, be in immediate charge of such officials or employees as it shall designate.

SECTION 6. Powers of Individual Commissioners. Any investigation, inquiry or hearing which the commission is authorized to hold or undertake may be held or undertaken by or before any commissioner, and the award, decision or order of a commissioner, when approved and confirmed by the commission and ordered filed in its office, shall be deemed to be the award, decision or order of the commission. Each commissioner shall, for the purpose of this act, have power to administer oaths, certify to official acts, take depositions, issue subpoenas, and compel the attendance of witnesses and the production of books, accounts, papers, records, documents and testimony.

SECTION 7. Powers of Commission. The commission may adopt all reasonable rules and regulations and do all things necessary to put into effect the provisions of this act. The commission shall, upon presentation of evidence, which shall have been previously presented to the medical advisory board, that any physician, surgeon, dentist or nurse, practising under the act, is incompetent, neglectful of his duty and dishonest, be empowered to suspend or debar such physician, surgeon, dentist or nurse from practice under the act, and the decision of the commission shall be final.

SECTION 8. Payment of Commonwealth Contributions. The commission shall estimate the contribution of the commonwealth annually before the first day of January of each year and shall, before that date, apportion it among the funds and societies, in proportion to their estimated expenditures for the purposes of this act during the year, and shall notify the treasurer of the commonwealth of the sum to be

paid on March thirty-first, June thirtieth, September thirtieth, and December thirty-first of the current year to each fund and society. The treasurer shall pay the amount out of the unexpended balance of any appropriation in his hands for the purpose.

SECTION 9. Guarantee Fund. The commission shall reserve ten per cent. of the contributions of the commonwealth to the funds and societies and pay it into a fund to be known as the guarantee fund, from which it may contribute for the relief of any fund or society on the application of its board of directors after investigation by the commission. A contribution shall be made only where, in the judgment of the commission, the necessity arises from the epidemic, catastrophe or other unusual conditions, and shall never be made where, in the opinion of the commission, the deficit is due to failure or refusal of the directors to levy proper rates of contribution. When and so long as in the opinion of the commission the guarantee fund is sufficient, the commission shall make no reservation for this purpose.

SECTION 10. Treasurer of the Commonwealth Custodian of Fund. The treasurer of the commonwealth shall be the custodian of the guarantee fund, and all disbursements therefrom shall be paid by him upon vouchers authorized by the commission and signed by the chairman or another member designated by him in writing. The treasurer of the commonwealth shall give a separate and additional bond in amount to be fixed by the governor and with securities approved by the auditor of the commonwealth conditioned for the faithful performance of his duty as custodian of the guarantee fund. The treasurer of the commonwealth may deposit any portion of the fund not needed for immediate use in the manner and subject to all the provisions of law respecting the deposit of other commonwealth funds by him. Interest earned by such portion of the guarantee fund deposited by the treasurer of the commonwealth shall be collected by him and placed to the credit of the fund.

SECTION 11. Report of Commission. Annually on or before the first day of February, the commission shall make a report to the governor, which he shall lay before the legislature, which shall include a statement of the apportionment of the contribution of the commonwealth statistics of sickness experience under this act, a detailed statement of the expense of the commission, the condition of the guarantee fund, together with any other matter which the commission deem proper to report, including any recommendations it may desire to make.

SECTION 12. Health Insurance Council. The health insurance council shall consist of twelve members, six of whom shall be elected by employer directors and six by employee directors of the local and trade funds; their term of office shall be two years, except that in the first election three of the employer and three of the employee members of the council shall be elected for one year; they shall receive a compensation of five dollars a day for each day spent on the business of the council, and shall be reimbursed for reasonable expenses incurred in connection with such business, to be paid as other expenses of the commission are paid.

SECTION 13. Officers of Council. The council shall elect a president from its own number; the secretary of the commission shall act as secretary of the council.

SECTION 14. Meeting of Council. The council shall meet during the first week of January, of April, of July, of September, each year. Special meetings shall be called by the president on the request of at least five members of the council or of two members of the commission, at any time.

SECTION 15. Duties of Council. The annual report and recommendations of the commission shall be laid before the January meeting of the council before transmission to the governor, and the council may approve them or make a separate report and recommendations to the governor. All general regulations proposed by the commission shall be laid before the

council at a regular or special meeting for discussion before final adoption, except in cases of urgency, to be determined by the commission, and in this case the regulation shall be laid before the next regular meeting of the council or a special meeting for the purpose.

SECTION 16. Medical Advisory Board. There shall be a medical advisory board of eleven members. The commissioner of health of the commonwealth and the secretary of the State Board of Registration in Medicine shall be ex-officio members of the board, seven members shall be chosen by the Medical Society of the State, and two by the Homeopathic Medical Society of the State. The term of office of chosen members shall be three years, except that the members first chosen shall choose by lot three of their number to go out of office at the end of one year and three at the end of two years. The board shall elect its own chairman and other officers. Its members shall be paid necessary expenses, but no salaries.

SECTION 17. Powers of Medical Advisory Board. All regulations of the commission relating to physicians and to medical benefits shall be referred to the medical advisory board and shall not be approved by the commission until after the first regular meeting of the board after such reference, unless sooner acted upon by the board, except in case of an emergency, when the commission may issue a temporary regulation for a period of not over six months. The medical advisory board shall make recommendations to the commission on standards for the hospitals and dispensaries which provide service under the act; for admission to practice under the act as specialists; and for obstetrical care. Such recommendations of the medical advisory board shall be effective on approval by the commission.

SECTION 18. Meetings of the Medical Advisory Board. The board shall meet at least once every three months and may be called together at any time on one week's notice by the chairman or by a call signed by any five members or by the commission. A majority of the members of the board shall constitute a quorum.

SECTION 19. Settlement of Disputes. All disputes arising under the act shall be determined by the commission either on appeal or, in case of disputes between funds and societies, by original proceedings. The commission may assign any dispute except disputes in regard to medical benefit, for hearing and determination to a dispute committee composed of one employer and one employee member of the council, and a member of the commission, as chairman, the members of the council to serve in turn on the dispute committee for periods of one month. Either party may appeal to the commission from the decision of the dispute committee within thirty days from the date of rendering the decision.

SECTION 20. Medical Disputes. All disputes regarding medical benefit, which have been appealed to the commission, shall be referred by the commission to the medical advisory board, which shall report to the commission, and the commission shall not decide any such dispute until after a report has been made by the board.

SECTION 21. Nurses' Advisory Board. The State Nurses' Association shall choose a Nurses' Advisory Board, of seven members, which shall be advisory to the commission on all matters relating to nursing service.

SECTION 22. Suits at Law. Suits shall not be brought in any court on any matter on which an appeal is allowed to the commission until after a decision by the commission, or of a dispute committee, and the statutes of limitations shall not begin to run in such cases until after the decision is filed.

PART VI.

MISCELLANEOUS PROVISIONS.

SECTION 1. Limitations of Claims. No claim for benefit shall be valid unless made to the board of

directors of the proper fund or society within one year from the time when the benefit was due.

SECTION 2. Disclosure Prohibited. Information acquired by the commission or a fund, or any of their officers or employees, from employers or employees pursuant to this act, shall not be opened to public inspection, and any such officer or employee who, without authority of the commission or pursuant to its rules, or as otherwise acquired by law, shall disclose the same, shall be guilty of a misdemeanor.

SECTION 3. Unauthorized Deductions from Wages Prohibited. An employer shall not deduct from the wages or salary of an employee any part of any contribution required to be borne by the employer, or make any agreement with the employee for the repayment of any part of such contribution. Any employer who violates this section is guilty of a misdemeanor and upon conviction shall be punished by a fine of not more than ten dollars. Every deduction or repayment in the case of each employee shall constitute a separate violation.

SECTION 4. Penalties. Any person who:

1. Prevents or obstructs the audit of a payroll, as authorized by this act;

2. Knowingly makes any false statement or false representation for the purpose of obtaining any benefit or payment, under this act, either for himself or any other person; or

3. Willfully violates or fails to comply with this act or any regulation or order made by the commission;

is guilty of a misdemeanor.

SECTION 5. Technical Rules of Evidence or Procedure Not Required. The commissioner or a deputy commissioner or dispute committee, in making an investigation or inquiry or conducting a hearing, shall not be bound by common law or statutory rules of evidence or by technical or formal rules of procedure, except as provided by this act, but may make such investigation or inquiry or conduct such hearing in such manner as to ascertain the substantial rights of the parties.

SECTION 6. When to Take Effect. This act shall take effect immediately, except that the provisions as to the payment of contributions shall not take effect until April first, nineteen hundred and eighteen, and the first payment of contributions by the commonwealth shall not be made until June thirtieth, nineteen hundred and eighteen; the provisions as to the benefits shall not take effect until July thirty-first, nineteen hundred and eighteen; provided, that if a fund or society is authorized after January first, nineteen hundred and eighteen, the provisions as to the benefits shall not take effect until three months after authorization.

Correspondence.

THE ANTI-VACCINATION CAMPAIGN.

Worcester, Jan. 25, 1917.

Mr. Editor: Let no one underestimate the vigor of the anti-vaccination campaign.

To every legislator has been mailed a yellow sheet entitled "Why compulsory vaccination" and this sheet and a report of the anti-vaccination side of the legislative hearing of last year have been distributed in at least one convention of women.

I call on every member of the Massachusetts Medical Society to impress upon his member of the legislature the importance of retaining upon the statute books the requirements for vaccination of public school children, which protects and practically renders immune so many thousands of those who, unprotected, would be the first to suffer in a smallpox epidemic.

Very sincerely yours,

SAMUEL B. WOODWARD, M.D.
President Massachusetts Medical Society.